Compaq
Array Configuration Utility XE

User Guide

Part Number 239449-003

April 2002 (Third Edition)

Product Version: 1.1

COMPAQ

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About This Guide

This guide provides step-by-step instructions for installation and use of the Compaq Array Configuration Utility XE.

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.

CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

IMPORTANT: Text set off in this manner presents clarifying information or specific instructions.

NOTE: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Text Conventions

This document uses the following conventions:

- *Italic type* is used for complete titles of published guides or variables. Variables include information that varies in system output, in command lines, and in command parameters in text.

- **Bold type** is used for emphasis, for onscreen interface components (window titles, menu names and selections, button and icon names, and so on), and for keyboard keys.
- `Monospace typeface` is used for command lines, code examples, screen displays, error messages, and user input.
- Sans serif typeface is used for uniform resource locators (URLs).

Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations.

Compaq Technical Support

In North America, call the Compaq Technical Support Phone Center at 1-800-OK-COMPAQ. This service is available 24 hours a day, 7 days a week. For continuous quality improvement, calls may be recorded or monitored. Outside North America, call the nearest Compaq Technical Support Phone Center. Telephone numbers for worldwide Technical Support Centers are listed on the Compaq website, www.compaq.com.

Be sure to have the following information available before you call Compaq:

- Technical support registration number (if applicable)
- Product serial number
- Product model name and number
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level

Compaq Website

The Compaq website has information on this product. You can access the Compaq website at www.compaq.com.

Compaq Authorized Reseller

For the name of your nearest Compaq authorized reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, see the Compaq website for locations and telephone numbers.

Reader's Comments

Compaq welcomes your comments on this guide. Please send your comments and suggestions by email to `ServerDocumentation@compaq.com`.

1

Getting Started

Features and System Requirements

The Compaq Array Configuration Utility XE is a browser-based utility that:

- Can be used any time that the server is on
- Has different operating modes, allowing faster configuration or greater control over the configuration options
- Suggests the optimum configuration for an unconfigured system
- Provides on-screen tips for individual steps of a configuration procedure
- Allows online array capacity expansion, logical drive capacity extension, assignment of online spares, and RAID or stripe size migration

The minimum display settings for optimum performance are 1024 × 768 resolution and 256 colors. Refer to the *README.TXT* file for further information about browser and operating system support.

Running the Array Configuration Utility XE

You can run the Array Configuration Utility XE directly from the software component, or you can run it from *Compaq Insight Manager*™ XE.

Using the Component

1. Download the Array Configuration Utility XE component from the website or from the CD supplied with the controller.
2. Install the component onto your system.

   When installation is complete, the Array Configuration Utility XE icon displays in the system tray.
3. Click **Start** and navigate to **Programs, Compaq System Tools, Compaq Array Configuration Utility XE.**
4. Select whether or not you would like to enable remote access.

   If remote access is disabled, the Array Configuration Utility XE can only be run on the server that has the component installed.
5. Open your browser.

   — If remote access is enabled, enter the following text into the URL field (where *SERVERNAME* is the name or IP address of the host):

   `http:\\SERVERNAME:2301`

   — If remote access is disabled, enter the following text into the URL field:

   `127.0.0.1`

   The **Device Home Page** for Compaq Web-Based Management displays.
6. Click **anonymous** near the top of the screen.

   A login screen displays.
7. Enter your user name and password (user name and password default to administrator/administrator.)

   NOTE: To change the user name or password, click the appropriate link on this screen. The choice of user name is limited to user, operator, or administrator.

   The **Device Home Page** is displayed again.
8. Click **Compaq Array Configuration Utility XE.**

The Array Configuration Utility XE searches for controllers that are connected to your system and identifies them. This process may take a minute or two.

When controller detection is complete, the introductory screen is displayed.

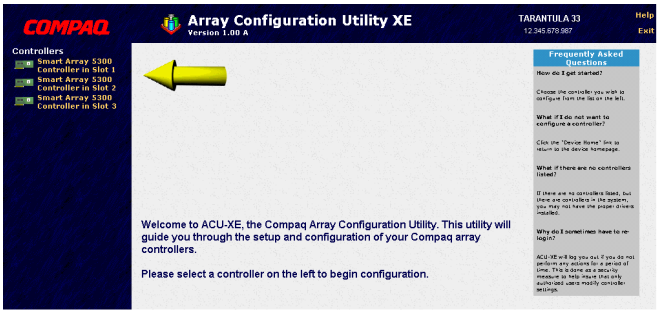

COMPAQ
Array Configuration Utility XE
Version 1.00 A
TARANTULA 33
12.345.678.987
Help
Exit
Controllers
Smart Array 5300 Controller in Slot 1
Smart Array 5300 Controller in Slot 2
Smart Array 5300 Controller in Slot 3
Frequently Asked Questions
How do I get started?
What if I do not want to configure a controller?
What if there are no controllers listed?
Why do I sometimes have to re-login?
Welcome to ACU-XE, the Compaq Array Configuration Utility. This utility will guide you through the setup and configuration of your Compaq array controllers.
Please select a controller on the left to begin configuration.

Figure 1-1: Introductory screen

Using Compaq Insight Manager XE

1. On the server where the Array Configuration Utility XE is located, be sure that the Array Configuration Utility XE is configured to allow remote access.
2. On the remote system, connect to the Compaq Insight Manager XE server (port :280) and log in.
3. Select **Device Queries.** Under **Device by Type,** select **All Servers.**
4. Connect to the server that is running the Array Configuration Utility XE.
5. Under **Device Links,** select the **Device Home Page.**
6. Click **Compaq Array Configuration Utility XE** near the bottom of the screen.

The Array Configuration Utility XE searches for controllers that are connected to your system and identifies them. This process may take a minute or two.

When controller detection is complete, the introductory screen (Figure 1-1) is displayed.

Configuration Mode Selection Screen

When you select a controller, the configuration mode selection screen (Figure 1-2) opens. Your screen may be different from the screen shown in the figure for these reasons:

- If the controller that you selected is unconfigured, the gray section of the screen shows only unassigned drives. Arrays, logical drives, and unused space are absent.
- **Express Configuration** is listed only if there is unused space or an unassigned drive on the selected controller.
- **Assisted Configuration** uses a set of wizards to guide you through the manual configuration process.
- **Advanced Configuration** provides the greatest flexibility and allows you to configure the controller manually without using wizards.

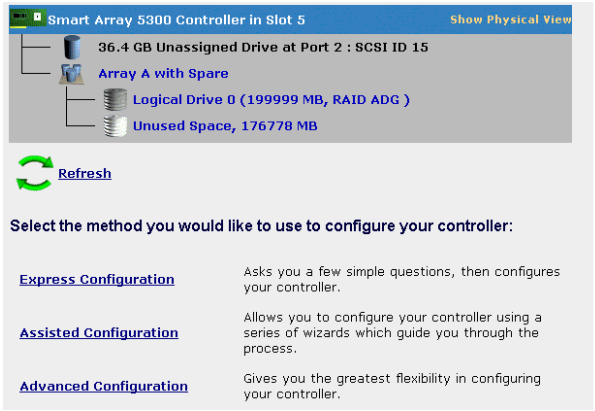

Smart Array 5300 Controller in Slot 5
Show Physical View
36.4 GB Unassigned Drive at Port 2 : SCSI ID 15
Array A with Spare
Logical Drive 0 (199999 MB, RAID ADG)
Unused Space, 176778 MB
Refresh
Select the method you would like to use to configure your controller:
Express Configuration
Asks you a few simple questions, then configures your controller.
Assisted Configuration
Allows you to configure your controller using a series of wizards which guide you through the process.
Advanced Configuration
Gives you the greatest flexibility in configuring your controller.

Figure 1-2: Configuration mode selection screen

Details of the subsequent steps in the controller configuration procedure are given in the next two chapters of this guide.

- If the controller is not configured (it has no arrays or logical drives, only unassigned physical drives), refer to Chapter 2.

- If the controller is already configured but you want to reconfigure it, refer to Chapter 3.

Description of Screen Regions

The appearance of a typical screen depends on which of the three configuration modes (**Express, Assisted,** or **Advanced**) you use. **Assisted** and **Express** modes use wizards to guide you through the configuration process; **Advanced** mode lets you configure your system without help from wizards.

Typical Wizard-Based Screen

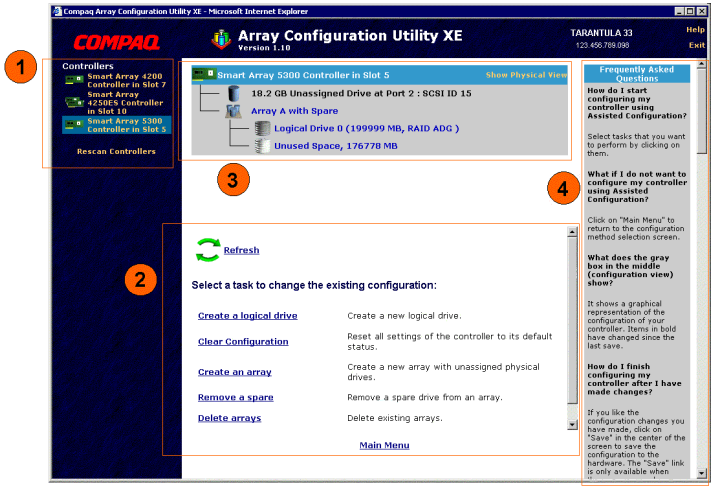

Compaq Array Configuration Utility XE - Microsoft Internet Explorer
COMPAQ
Array Configuration Utility XE
Version 1.10
TARANTULA 33
123.456.789.098
Help
Exit
1
Controllers
Smart Array 4200 Controller in Slot 7
Smart Array 425DES Controller in Slot 10
Smart Array 5300 Controller in Slot 5
Rescan Controllers
Smart Array 5300 Controller in Slot 5
Show Physical View
18.2 GB Unassigned Drive at Port 2 : SCSI ID 15
Array A with Spare
Logical Drive 0 (199999 MB, RAID ADG)
Unused Space, 176778 MB
3
4
2
Refresh
Select a task to change the existing configuration:
Create a logical drive
Create a new logical drive.
Clear Configuration
Reset all settings of the controller to its default status.
Create an array
Create a new array with unassigned physical drives.
Remove a spare
Remove a spare drive from an array.
Delete arrays
Delete existing arrays.
Main Menu
Frequently Asked Questions
How do I start configuring my controller using Assisted Configuration?
Select tasks that you want to perform by clicking on them.
What if I do not want to configure my controller using Assisted Configuration?
Click on "Main Menu" to return to the configuration method selection screen.
What does the gray box in the middle (configuration view) show?
It shows a graphical representation of the configuration of your controller. Items in bold have changed since the last save.
How do I finish configuring my controller after I have made changes?
If you like the configuration changes you have made, click on "Save" in the center of the screen to save the configuration to the hardware. The "Save" link is only available when

Figure 1-3: Screen regions in wizard

1 The controller selection list shows all the identifiable controllers that are connected to your system.

2 The main menu shows the allowable options at this stage.

3 The configuration view window shows all arrays, logical drives, unused space, and unassigned physical drives that are connected to the selected controller. The logical view is shown by default.

   Click an icon to display a popup window (refer to Figure 1-4 for an example) listing further information about the corresponding item.

   Change to the physical view at any time by clicking **Show Physical View** in the upper right-hand corner of the window.

4 The **Frequently Asked Questions** (FAQ) column lists information and tips relevant to the current screen. Review this region before clicking **Help** in the upper right-hand corner of the browser screen.

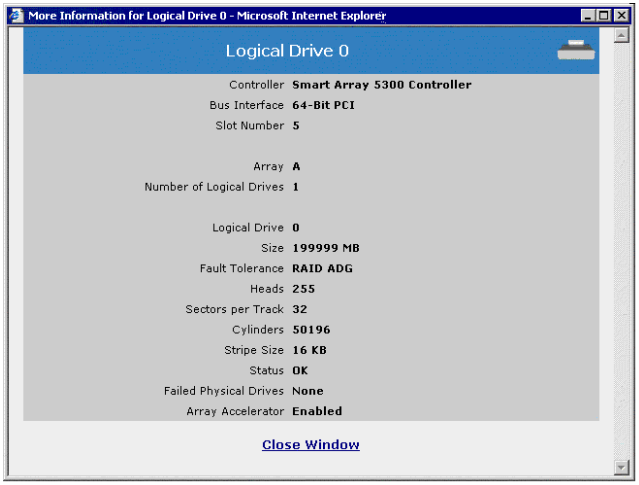


Figure 1-4: Typical More Information popup window

Typical Advanced Mode Screen

This mode shows all the configuration options for a particular device at the same time, in a frame on the right-hand side of the screen. The FAQ column is absent.

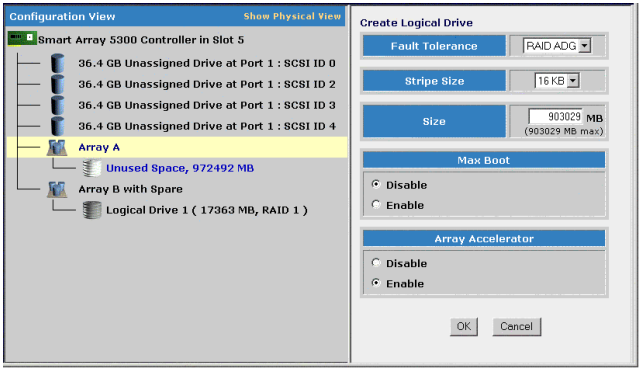


Figure 1-5: Typical advanced mode screen

2

Configuring a New Controller

Log in as described in Chapter 1 and select a controller.

When you select an unconfigured controller, the configuration mode selection screen (Figure 2-1) opens.

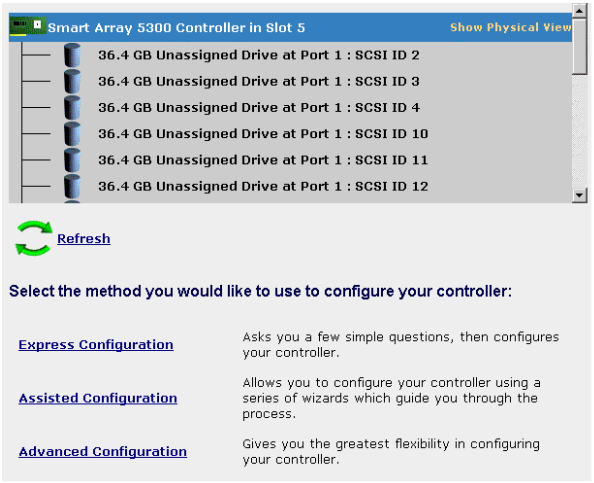

Smart Array 5300 Controller in Slot 5
Show Physical View
36.4 GB Unassigned Drive at Port 1 : SCSI ID 2
36.4 GB Unassigned Drive at Port 1 : SCSI ID 3
36.4 GB Unassigned Drive at Port 1 : SCSI ID 4
36.4 GB Unassigned Drive at Port 1 : SCSI ID 10
36.4 GB Unassigned Drive at Port 1 : SCSI ID 11
36.4 GB Unassigned Drive at Port 1 : SCSI ID 12
Refresh
Select the method you would like to use to configure your controller:
Express Configuration
Asks you a few simple questions, then configures your controller.
Assisted Configuration
Allows you to configure your controller using a series of wizards which guide you through the process.
Advanced Configuration
Gives you the greatest flexibility in configuring your controller.

Figure 2-1: Configuration mode selection screen

If you select a controller that is already configured, arrays and logical drives are also present in the gray box, rather than just unassigned physical drives. The procedure for reconfiguring a previously configured controller is described in Chapter 3.

These methods are available for configuring the controller:

- **Express Configuration** automatically sets up the optimum configuration for the controller after you have answered a few simple questions.
- **Assisted Configuration** uses a set of wizards to guide you through the manual configuration process.
- **Advanced Configuration** provides the greatest flexibility and lets you configure the controller manually without using wizards.

Using Express Configuration Mode

1. Click **Express Configuration.** The express mode start screen is displayed.

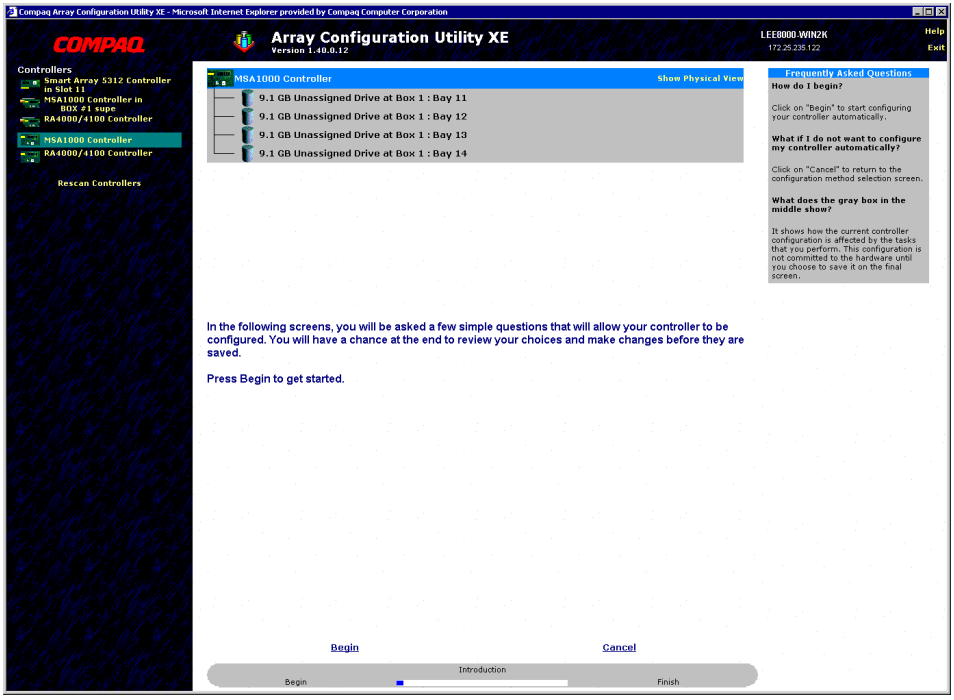

Compaq Array Configuration Utility XE - Microsoft Internet Explorer provided by Compaq Computer Corporation
COMPAQ
Array Configuration Utility XE
Version 1.40.0.12
LEE8000-WIN2K
172.25.235.122
Help
Exit
Controllers
Smart Array 5312 Controller in Slot 11
MSA1000 Controller in BOX #1 supe
RA4000/4100 Controller
MSA1000 Controller
RA4000/4100 Controller
Rescan Controllers
MSA1000 Controller
Show Physical View
9.1 GB Unassigned Drive at Box 1 : Bay 11
9.1 GB Unassigned Drive at Box 1 : Bay 12
9.1 GB Unassigned Drive at Box 1 : Bay 13
9.1 GB Unassigned Drive at Box 1 : Bay 14
Frequently Asked Questions
How do I begin?
Click on "Begin" to start configuring your controller automatically.
What if I do not want to configure my controller automatically?
Click on "Cancel" to return to the configuration method selection screen.
What does the gray box in the middle show?
It shows how the current controller configuration is affected by the tasks that you perform. This configuration is not committed to the hardware until you choose to save it on the final screen.
In the following screens, you will be asked a few simple questions that will allow your controller to be configured. You will have a chance at the end to review your choices and make changes before they are saved.
Press Begin to get started.
Begin
Cancel
Introduction
Begin
Finish

Figure 2-2: Express mode start screen

2. Click **Begin.**

The Array Configuration Utility XE uses all of the physical drives attached to the controller to create the optimum number of arrays and logical drives. This process takes a few moments; when it is finished, the screen is updated. The gray configuration view window shows the new configuration (refer to Figure 2-3), and underneath this window is a list of possible fault-tolerance levels for the first logical drive.

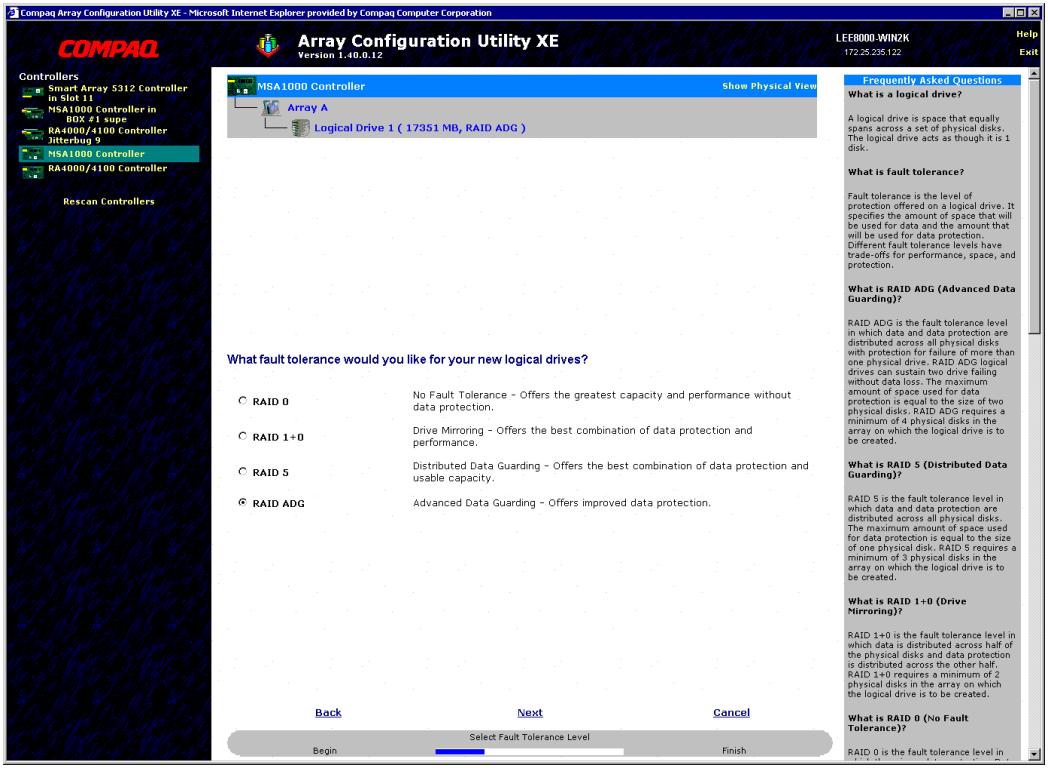

Compaq Array Configuration Utility XE - Microsoft Internet Explorer provided by Compaq Computer Corporation
COMPAQ
Array Configuration Utility XE
Version 1.40.0.12
LEE8000-WIN2K
172.25.235.122
Help
Exit
Controllers
Smart Array 5312 Controller in Slot 11
MSA1000 Controller in BOX #1 supe
RA4000/4100 Controller Jitterbug 9
MSA1000 Controller
RA4000/4100 Controller
Rescan Controllers
MSA1000 Controller
Show Physical View
Array A
Logical Drive 1 (17351 MB, RAID ADG)
What fault tolerance would you like for your new logical drives?
RAID 0
No Fault Tolerance - Offers the greatest capacity and performance without data protection.
RAID 1+0
Drive Mirroring - Offers the best combination of data protection and performance.
RAID 5
Distributed Data Guarding - Offers the best combination of data protection and usable capacity.
RAID ADG
Advanced Data Guarding - Offers improved data protection.
Back
Next
Cancel
Select Fault Tolerance Level
Begin
Finish
Frequently Asked Questions
What is a logical drive?
A logical drive is space that equally spans across a set of physical disks. The logical drive acts as though it is 1 disk.
What is fault tolerance?
Fault tolerance is the level of protection offered on a logical drive. It specifies the amount of space that will be used for data and the amount that will be used for data protection. Different fault tolerance levels have trade-offs for performance, space, and protection.
What is RAID ADG (Advanced Data Guarding)?
RAID ADG is the fault tolerance level in which data and data protection are distributed across all physical disks with protection for failure of more than one physical drive. RAID ADG logical drives can sustain two drive failing without data loss. The maximum amount of space used for data protection is equal to the size of two physical disks. RAID ADG requires a minimum of 4 physical disks in the array on which the logical drive is to be created.
What is RAID 5 (Distributed Data Guarding)?
RAID 5 is the fault tolerance level in which data and data protection are distributed across all physical disks. The maximum amount of space used for data protection is equal to the size of one physical disk. RAID 5 requires a minimum of 3 physical disks in the array on which the logical drive is to be created.
What is RAID 1+0 (Drive Mirroring)?
RAID 1+0 is the fault tolerance level in which data is distributed across half of the physical disks and data protection is distributed across the other half. RAID 1+0 requires a minimum of 2 physical disks in the array on which the logical drive is to be created.
What is RAID 0 (No Fault Tolerance)?
RAID 0 is the fault tolerance level in

Figure 2-3: Choosing a RAID level

3. Select a RAID level, and then click **Next.**

   If you have selected a fault-tolerant RAID method, and an unassigned physical drive of the appropriate capacity is available, the Array Configuration Utility XE asks if you want to assign a spare drive. Make your selection, and then click **Next.**

4. The screen displays the selected configuration and asks you to confirm that it is acceptable.
   - — Discarding the suggested configuration returns you to the configuration mode selection screen (Figure 2-1) so that you can configure the new array manually.
   - — Accepting the suggested configuration produces a screen confirming that the Array Configuration Utility XE has saved the new configuration. At this point, you can configure another controller or you can exit the Array Configuration Utility XE.
5. Select the appropriate radio button.
6. Click **Finish.**

Using Assisted Configuration Mode

Creating an Array

1. Click **Assisted Configuration.**
2. Click **Create an array,** and then click **Begin.** The physical drive selection screen is displayed. (In larger configurations, use the scrollbars in the configuration view region to see all the physical drives and arrays connected to the controller.)

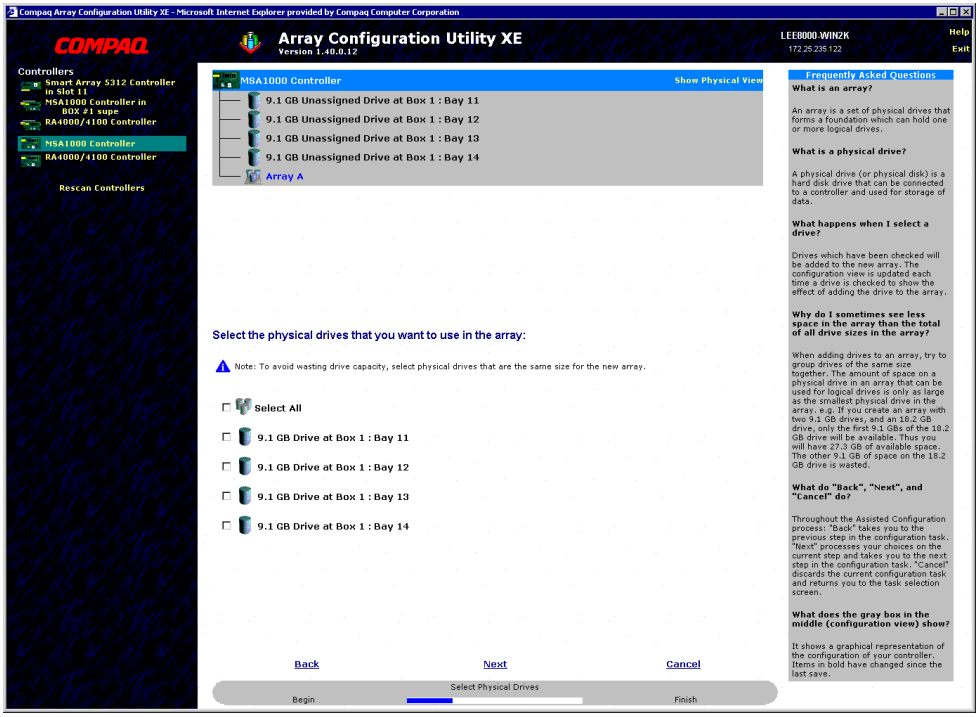

Compaq Array Configuration Utility XE - Microsoft Internet Explorer provided by Compaq Computer Corporation
COMPAQ
Array Configuration Utility XE
Version 1.40.0.12
LEE8000-WIN2K
172.25.235.122
Help
Exit
Controllers
Smart Array 5312 Controller in Slot 11
MSA1000 Controller in BOX #1 supe
RA4000/4100 Controller
MSA1000 Controller
RA4000/4100 Controller
Rescan Controllers
MSA1000 Controller
Show Physical View
9.1 GB Unassigned Drive at Box 1 : Bay 11
9.1 GB Unassigned Drive at Box 1 : Bay 12
9.1 GB Unassigned Drive at Box 1 : Bay 13
9.1 GB Unassigned Drive at Box 1 : Bay 14
Array A
Frequently Asked Questions
What is an array?
An array is a set of physical drives that forms a foundation which can hold one or more logical drives.
What is a physical drive?
A physical drive (or physical disk) is a hard disk drive that can be connected to a controller and used for storage of data.
What happens when I select a drive?
Drives which have been checked will be added to the new array. The configuration view is updated each time a drive is checked to show the effect of adding the drive to the array.
Why do I sometimes see less space in the array than the total of all drive sizes in the array?
When adding drives to an array, try to group drives of the same size together. The amount of space on a physical drive in an array that can be used for logical drives is only as large as the smallest physical drive in the array. e.g. If you create an array with two 9.1 GB drives, and an 18.2 GB drive, only the first 9.1 GBs of the 18.2 GB drive will be available. Thus you will have 27.3 GB of available space. The other 9.1 GB of space on the 18.2 GB drive is wasted.
What do "Back", "Next", and "Cancel" do?
Throughout the Assisted Configuration process: "Back" takes you to the previous step in the configuration task. "Next" processes your choices on the current step and takes you to the next step in the configuration task. "Cancel" discards the current configuration task and returns you to the task selection screen.
What does the gray box in the middle (configuration view) show?
It shows a graphical representation of the configuration of your controller. Items in bold have changed since the last save.
Select the physical drives that you want to use in the array:
Note: To avoid wasting drive capacity, select physical drives that are the same size for the new array.
Select All
9.1 GB Drive at Box 1 : Bay 11
9.1 GB Drive at Box 1 : Bay 12
9.1 GB Drive at Box 1 : Bay 13
9.1 GB Drive at Box 1 : Bay 14
Back
Next
Cancel
Select Physical Drives
Begin
Finish

Figure 2-4: Physical drive selection screen

3. Select the physical drives that you want to use in the array.

   — Use physical drives of comparable capacity.

   The Array Configuration Utility XE uses the same amount of space from each physical drive to build an array. Because this amount cannot exceed the capacity of the smallest physical drive, any excess capacity of the other drives in the array is unusable.

   — For better system performance, use physical drives that are connected to different ports on the controller.

   — In RAID 5 configurations, keep the risk of logical drive failure low by assigning no more than 14 physical drives to the array.

   Each time that you add a physical drive to the array, the configuration view is updated to show how much free space is on the array.

4. Click **Next** when you have finished selecting physical drives.

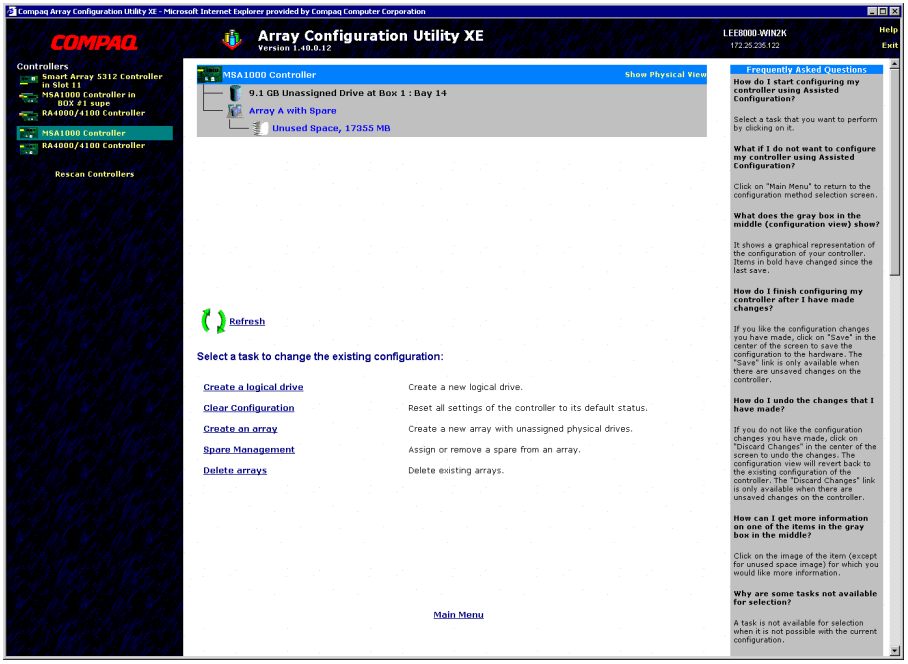
   If an unassigned physical drive of the appropriate capacity is available, you are asked whether you want to assign a spare drive to the array.

   — If you do not want a spare, click **No,** and then click **Next.**

   — To assign spares, click **Yes,** and then click **Next.** On the next screen, select the drives that you want to be the spare, and then click **Next.**

NOTE: An array can have more than one spare, and a spare can be shared by several arrays.

5. Click **Finish** to confirm the configuration. The configured array screen is displayed.


Compaq Array Configuration Utility XE - Microsoft Internet Explorer provided by Compaq Computer Corporation
COMPAQ
Array Configuration Utility XE
Version 1.40.0.12
LEE8000-WIN2K
172.25.236.122
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Smart Array 5312 Controller in Slot 11
MSA1000 Controller in BOX #1 supe
RA4000/4100 Controller
MSA1000 Controller
RA4000/4100 Controller
Rescan Controllers
MSA1000 Controller
Show Physical View
9.1 GB Unassigned Drive at Box 1 : Bay 14
Array A with Spare
Unused Space, 17355 MB
Frequently Asked Questions
How do I start configuring my controller using Assisted Configuration?
Select a task that you want to perform by clicking on it.
What if I do not want to configure my controller using Assisted Configuration?
Click on "Main Menu" to return to the configuration method selection screen.
What does the gray box in the middle (configuration view) show?
It shows a graphical representation of the configuration of your controller. Items in bold have changed since the last save.
How do I finish configuring my controller after I have made changes?
If you like the configuration changes you have made, click on "Save" in the center of the screen to save the configuration to the hardware. The "Save" link is only available when there are unsaved changes on the controller.
How do I undo the changes that I have made?
If you do not like the configuration changes you have made, click on "Discard Changes" in the center of the screen to undo the changes. The configuration view will revert back to the existing configuration of the controller. The "Discard Changes" link is only available when there are unsaved changes on the controller.
How can I get more information on one of the items in the gray box in the middle?
Click on the image of the item (except for unused space image) for which you would like more information.
Why are some tasks not available for selection?
A task is not available for selection when it is not possible with the current configuration.
Refresh
Select a task to change the existing configuration:
Create a logical drive
Create a new logical drive.
Clear Configuration
Reset all settings of the controller to its default status.
Create an array
Create a new array with unassigned physical drives.
Spare Management
Assign or remove a spare from an array.
Delete arrays
Delete existing arrays.
Main Menu

Figure 2-5: Configured array screen (no logical drives)

Creating a Logical Drive

1. Click **Create a logical drive** (refer to Figure 2-5), and then click **Begin.**
2. Select the array with unused space that you want to use to build the logical drive, and then click **Next.**
3. Select the fault-tolerance level, and then click **Next.**

   Only RAID levels that are possible for this configuration are shown. For example, RAID 5 is not listed if the array has only two physical drives.
4. Select the stripe size, and then click **Next.**

   The default stripe size gives optimum performance in a mixed read/write environment. If your system is used in a different environment, use Table 2-1 to determine optimum stripe size.

Table 2-1: Optimum Stripe Size

Type of Server Application	Suggested Stripe Size Change
Mixed read/write	Accept the default value
Mainly sequential read (such as audio/video applications)	Larger stripe sizes work best
Mainly write (such as image manipulation applications)	Smaller stripes for RAID 5, RAID ADG Larger stripes for RAID 0, RAID 1

5. Decide whether to use MaxBoot, and then click **Next.**

   MaxBoot increases the number of sectors used per track from 32 to 63. This increase allows a larger boot partition for operating systems that use cylinders, heads, and sectors of a physical drive to determine the drive size. (One such operating system is Microsoft Windows NT 4.0.)

   Logical drive performance is likely to decrease with MaxBoot enabled.
6. Set the logical drive size, and then click **Next.**

   The default size shown is the largest possible logical drive size for that RAID level and that set of physical drives. Reducing the size of the logical drive liberates drive space, which you can use to build additional logical drives on the same array.

7. If the controller has an array accelerator, a screen displays that lets you disable it for the currently selected logical drive. Select whether to disable the array accelerator, and then click **Next.**

   NOTE: Disabling the array accelerator for a logical drive reserves use of the accelerator cache for other logical drives on the array that need to have the maximum possible performance (such as those that contain database information).

   The gray configuration view window shows the configuration that you have selected.

8. Be sure that the configuration is acceptable, and then click **Finish.**

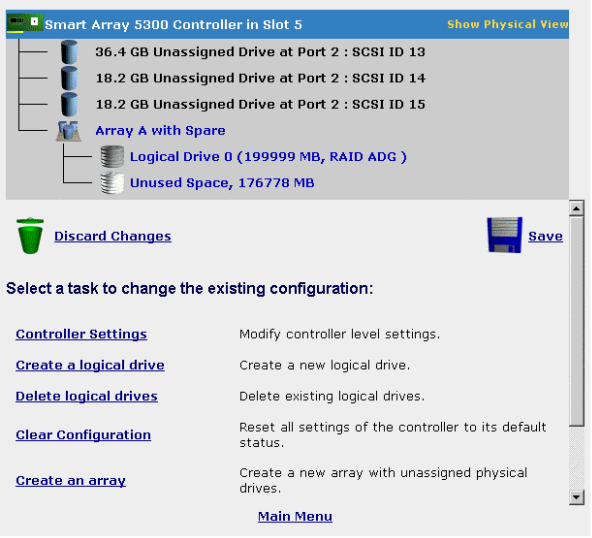

Smart Array 5300 Controller in Slot 5
Show Physical View
36.4 GB Unassigned Drive at Port 2 : SCSI ID 13
18.2 GB Unassigned Drive at Port 2 : SCSI ID 14
18.2 GB Unassigned Drive at Port 2 : SCSI ID 15
Array A with Spare
Logical Drive 0 (199999 MB, RAID ADG)
Unused Space, 176778 MB
Discard Changes
Save
Select a task to change the existing configuration:
Controller Settings
Modify controller level settings.
Create a logical drive
Create a new logical drive.
Delete logical drives
Delete existing logical drives.
Clear Configuration
Reset all settings of the controller to its default status.
Create an array
Create a new array with unassigned physical drives.
Main Menu

Figure 2-6: New logical drive before saving

9. Click **Save** to commit the changes to the controller, and then click **OK** on the confirmation alert. (If you discard the changes, all changes since the previous save are lost.)

To make further modifications to the array configuration, refer to Chapter 3.

Using Advanced Configuration Mode

1. On the configuration mode selection screen, click **Advanced Configuration**. The advanced mode start screen is displayed.

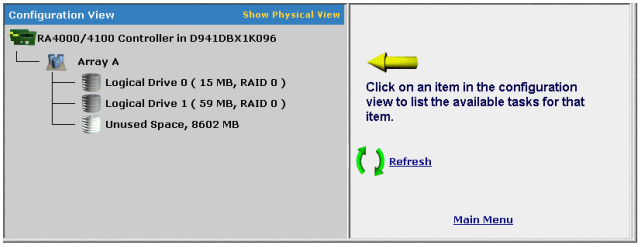

Configuration View
Show Physical View
RA4000/4100 Controller in D941DBX1K096
Array A
Logical Drive 0 (15 MB, RAID 0)
Logical Drive 1 (59 MB, RAID 0)
Unused Space, 8602 MB
Click on an item in the configuration view to list the available tasks for that item.
Refresh
Main Menu

Figure 2-7: Advanced mode start screen

2. Click an item in the **Configuration View** window. The screen displays a list of the tasks that are available for that item.

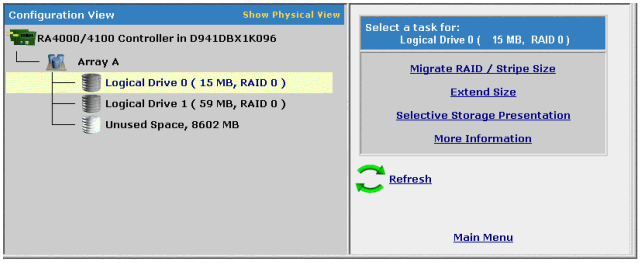

Configuration View
Show Physical View
RA4000/4100 Controller in D941DBX1K096
Array A
Logical Drive 0 (15 MB, RAID 0)
Logical Drive 1 (59 MB, RAID 0)
Unused Space, 8602 MB
Select a task for:
Logical Drive 0 (15 MB, RAID 0)
Migrate RAID / Stripe Size
Extend Size
Selective Storage Presentation
More Information
Refresh
Main Menu

Figure 2-8: Typical task list for a logical drive

The listed (available) tasks are a subset of the total number of tasks that are possible for the selected item. Which of the possible tasks are listed for an item and which are omitted depends on the current controller configuration and model. (For example, **Create Array** is not an available task for a controller item if there are no unassigned physical drives connected to the controller.) Table 2-2 lists all the possible tasks for every type of item.

The **More Information** task is present for all items except unused space. Clicking the link for this task causes a popup window to be displayed with additional information about the selected item. Refer to the "Description of Screen Regions" section in Chapter 1 for an example of this type of screen.

Table 2-2: Possible Tasks in Advanced Configuration Mode

Item	Available Tasks
Controller	Clear Configuration
	Controller Settings
	Create Array
	Logical Drive Array Accelerator Settings
	More Information
	Selective Storage Presentation (on MSA1000 controllers)
Array	Create Logical Drive
	Delete
	Expand
	Spare Management
	More Information
Logical drive	Delete
	Extend Size
	Migrate RAID / Stripe Size
	Selective Storage Presentation (on RA4x00 controllers)
	More Information
Unused space	(No available tasks associated with this item)

3. Click a task link. A list of all possible configuration options for that task is displayed on the right-hand side of the screen (replacing the task list). Refer to the "Description of Screen Regions" section in Chapter 1 for an example of this type of screen.
4. Set the configuration options.
5. Click **OK**.

3

Modifying an Existing Configuration

Log in as described in Chapter 1 and select the controller that you want to reconfigure. You may have the choice of using Express, Assisted, or Advanced Configuration modes, depending on the operating system being used and the current configuration of the controller.

Using Express Configuration Mode

This mode is available only if the selected controller has unassigned physical drives or unused space.

1. Click **Express Configuration,** and then click **Begin.**

   If there are unassigned physical drives on the controller, you can create a new array or expand an existing array. Make your selection, and then click **Next.**

   IMPORTANT: The expansion process takes about 15 minutes per gigabyte, or considerably longer if the controller does not have a battery-backed cache. While array expansion is occurring, no other expansion, extension, or migration can occur on the same controller.

   The screen displays the optimum configuration for the controller and asks you to confirm that it is acceptable.

2. Select the appropriate radio button, and then click **Finish.**

Using Assisted Configuration Mode

The options listed in the menu region of the screen depend on the controller model and the current configuration of your controller. For example, the **Expand array** option is listed only if there is at least one unassigned physical drive connected to the controller.

Possible menu options:

- Clear Configuration
- Controller Settings
- Create an array
- Create a logical drive
- Delete arrays
- Delete logical drives
- Expand array
- Extend logical drive
- Migrate a logical drive
- Spare Management
- Selective Storage Presentation

The following sections describe these options in more detail.

Clear Configuration

This option deletes all logical drives connected to the controller, reconfigures the arrays into independent (unassigned) physical drives, and resets all controller settings to their default values.

1. Click **Clear Configuration,** and then click **Begin.**

   A warning screen is displayed to remind you that you can lose all data on the logical drive. Click **Delete** to continue.

2. Click **Finish** to accept the changes.
3. Click **Save** to apply the changes to the system, and then click **OK** on the confirmation alert.

The physical drives are now available for reconfiguration.

Controller Settings

This option lets you alter the priority settings for array expansion and rebuild. You can also disable the array accelerator (if one is present) or change the ratio of read cache to write cache (if the controller has battery-backed cache).

The default controller settings provided by the Array Configuration Utility XE are adequate for many purposes. To change the controller settings:

1. Click **Controller Settings,** and then click **Begin.**

   The next two screens let you change the expand priority and the rebuild priority settings. These settings determine how much importance you want an array expansion or rebuild to have relative to normal I/O operations.

   — At the **low** priority setting, the expansion or rebuild takes place only when the array controller is not busy handling normal I/O requests. This setting has minimal effect on normal I/O operations. However, there is an increased risk that data will be lost if another physical drive fails while the rebuild is in progress.

   — At the **high** priority setting, the rebuild or expansion occurs at the expense of normal I/O operations. Although system performance is affected, this setting provides better data protection because the array is vulnerable to additional drive failures for a shorter time.

   — At the **medium** priority setting, expansion or rebuild occurs for half of the time, and normal I/O requests are handled during the rest of the time.

2. Set the expand priority to **high, medium,** or **low,** and then click **Next.**
3. Set the rebuild priority, and then click **Next.**

   If the controller has an array accelerator, a screen displays that lets you disable it for particular logical drives. Select whether to disable the array accelerator for any logical drives, and then click **Next.**

NOTE: Disabling the array accelerator for a particular logical drive reserves use of the accelerator cache for other logical drives on the array that need to have maximum possible performance (such as those that contain database information).

If the controller has a battery-backed cache, a screen displays that lets you change the read/write cache ratio. Select the controller ratio, and then click **Next.**

NOTE: This ratio determines the amount of cache memory allocated to read and write operations. Different types of applications have different optimum ratios. Only battery-backed cache can be used for write cache. You can only change the ratio if the controller has a battery-backed cache and if there are logical drives configured on the controller.

4. Click **Finish** to accept the changes.
5. Click **Save** to apply the changes to the system, and then click **OK** on the confirmation alert.

Create an Array

1. Click **Create an array,** and then click **Begin.**
2. Select the physical drives that you want to use in the array.
   - — Use physical drives of comparable capacity.

     The Array Configuration Utility XE uses the same amount of space from each physical drive to build an array. Because this amount cannot exceed the capacity of the smallest physical drive, any excess capacity of the other drives in the array is unusable.
   - — For better system performance, use physical drives that are attached to different ports on the controller.
   - — In RAID 5 configurations, keep the risk of logical drive failure low by assigning no more than 14 physical drives to the array.

   Each time that you add a physical drive to the array, the configuration view is updated to show how much free space is available on the array.
3. Click **Next** when you have finished adding physical drives to the array.

   If a spare or unassigned physical drive of the appropriate capacity is available, you can now assign a spare drive to the array.
   - — If you do not want a spare, click **No,** and then click **Next.**
   - — To assign spares, click **Yes,** and then click **Next.** On the next screen, select the spare drives, and then click **Next.**

NOTE: An array can have more than one spare, and a spare can be shared by several arrays.

4. Click through the remaining screens to confirm the configuration.

Create a Logical Drive

1. Click **Create a logical drive,** and then click **Begin.**
2. Select the array with unused space that you want to use to build the logical drive on, and then click **Next.**
3. Select the fault-tolerance level, and then click **Next.**

Only RAID levels that are possible for this configuration are shown. For example, RAID 5 is not listed if the array has only two physical drives.

4. Select the stripe size, and then click **Next.**

   The default stripe size gives optimum performance in a mixed read/write environment. If your system is used in a different environment, refer to Table 3-1 to determine optimum stripe size.

Table 3-1: Optimum Stripe Size

Type of Server Application	Suggested Stripe Size Change
Mixed read/write	Accept the default value
Mainly sequential read (such as audio/video applications)	Larger stripe sizes work best
Mainly write (such as image manipulation applications)	Smaller stripes for RAID 5, RAID ADG
	Larger stripes for RAID 0, RAID 1

5. Decide whether to use MaxBoot, and then click **Next**.

   MaxBoot increases the number of sectors used per track from 32 to 63. This increase allows a larger boot partition for operating systems that use cylinders, heads, and sectors of a physical drive to determine the drive size. (One such operating system is Microsoft Windows NT 4.0.)

   Logical drive performance is likely to decrease with MaxBoot enabled.

6. Set the logical drive size, and then click **Next**. The default size shown is the largest possible logical drive size for that RAID level and that set of physical drives. Reducing the size of the logical drive liberates drive space, which you can use to build additional logical drives on the same array.

7. If the controller has an array accelerator, a screen displays that lets you disable it for the currently selected logical drive. Select whether to disable the array accelerator for this logical drive, and then click **Next.**

   NOTE: Disabling the array accelerator for a particular logical drive reserves use of the accelerator cache for other logical drives on the array that need the maximum possible performance (such as those that contain database information).

The gray **Configuration View** window shows the configuration that you have selected.

8. Be sure that the configuration is acceptable, and then click **Finish.**
9. Click **Save** to apply the changes to the system, and then click **OK** on the confirmation alert.

Delete Arrays

This option deletes logical drives on an array and converts the array into a group of unassigned physical drives. You can then reconfigure the unassigned physical drives into one or more new arrays, or you can use the liberated physical drive space for expansion of another array on the same controller.

1. Click **Delete arrays,** and then click **Begin.**
2. Select the arrays that you want to delete, and then click **Next.** A warning screen is displayed to remind you that you will lose all data on the array.
3. Click **Delete** to continue, and then click **Finish** to accept the changes.
4. Click **Save** to apply the changes to the system, and then click **OK** on the confirmation alert.

Delete Logical Drives

This option deletes the selected logical drive and converts it into unused drive space. You can use this unused drive space to:

- Create new logical drives.
- Migrate the RAID level or stripe size of an existing logical drive.
- Extend an existing logical drive on the same array, if your operating system allows logical drive extension.

To delete a logical drive:

1. Click **Delete logical drives,** and then click **Begin.**
2. Select the logical drives that you want to delete, and then click **Next.** A warning screen is displayed to remind you that you will lose all data on the logical drive.

3. Click **Delete** to continue, and then click **Finish** to accept the changes.
4. Click **Save** to apply the changes to the system, and then click **OK** on the confirmation alert.

Expand Array

This option increases the storage capacity of an existing array. You can use the additional storage space to:

- Create new logical drives.
- Migrate the RAID level or stripe size of existing logical drives.
- Extend existing logical drives on the array, if your operating system allows logical drive extension.

1. **Expand array** is available only if the controller has unassigned physical drives of sufficient capacity to be added to an existing array. If this is not the case, install at least one physical drive (of the same capacity as existing drives in the array) on the controller, and then click **Refresh.**
2. Click **Controller Settings** and be sure that the expand priority setting is acceptable.
3. Back up all data on the array. Although array expansion is unlikely to cause data loss, observing this precaution provides additional data protection.
4. Click **Expand array,** and then click **Begin.**
5. Select the array that you want to expand, and then click **Next.**
6. Select the physical drives that you want to add to the array, and then click **Next.**
7. Click **Finish** to accept the changes.

   At this point (before clicking **Save** in the next step), you can create logical drives on the unused space created by the expansion. You can also arrange to expand another array on the same controller by repeating the previous steps. However, the controller can only expand one array at a time; remaining array expansions are queued.

IMPORTANT: The expansion process takes about 15 minutes per gigabyte, or considerably longer if the controller does not have a battery-backed cache. While array expansion is taking place, no other expansion, extension, or migration can occur on the same controller.

8. Click **Save.**

   The controller now rearranges (re-stripes) the existing logical drives and their data so that they extend over all the physical drives in the enlarged array.

To view the progress of an array expansion, click the logical drive icon for that array in the **Configuration View** window. A **More Information** popup window is displayed that lists the drive status.

Extend Logical Drive

This option increases the storage capacity of a logical drive by adding unused space on an array to a logical drive on the same array. The unused space is obtained either by array expansion (refer to the "Expand Array" section), or by deleting another logical drive on the same array.

IMPORTANT: Not all operating systems support online logical drive extension. Also, **offline** logical drive extension is possible for some operating systems by backing up data, reconfiguring the array, and restoring data from backup. Refer to the operating system documentation for current information.

IMPORTANT: The extension process takes about 15 minutes per gigabyte, or considerably longer if the controller does not have a battery-backed cache. While logical drive extension is taking place, no other expansion, extension, or migration can occur on the same controller.

1. Back up all data on the logical drive. Although logical drive extension is unlikely to cause data loss, observing this precaution provides additional data protection.
2. Click **Extend logical drive,** and then click **Begin.**
3. Select the logical drive that you want to extend, and then click **Next.**
4. Type the new size of the logical drive into the size field.
5. Click **Finish.**

At this point (before clicking **Save** in the next step), you can arrange to extend another logical drive on the same controller by repeating the previous steps. However, the controller can only extend one logical drive at a time; remaining extensions are queued.

6. Click **Save.** Logical drive extension begins.

To view the progress of a logical drive extension, click the icon for that logical drive in the **Configuration View** window. A **More Information** popup window is displayed that lists the drive status.

Migrate a Logical Drive

This option lets you alter the stripe size (data block size) or RAID level, or both, for a selected logical drive. The array might need to have unused space available for the migration to be possible, depending on the initial and final settings for the stripe size and RAID level.

IMPORTANT: The migration process takes about 15 minutes per gigabyte, or considerably longer if the controller does not have a battery-backed cache. While migration is taking place, no other expansion, extension, or migration can occur on the same controller.

1. Back up all data on the logical drive. Although migration is unlikely to cause data loss, observing this precaution provides additional data protection.
2. Click **Migrate a logical drive,** and then click **Begin.**
3. Select the logical drive, and then click **Next.**
4. Select the new RAID level, and then click **Next.**

   Only RAID levels that are possible for this configuration are shown. For example, RAID 5 is not listed if the array has only two physical drives.
5. Select the stripe size, and then click **Finish** to accept the changes.

   Only stripe sizes that are possible for this configuration are shown.

   At this point (before clicking **Save** in the next step), you can arrange to migrate another logical drive on the same controller by repeating the previous steps. However, the controller can only migrate one logical drive at a time; remaining migrations are queued.

6. Click **Save.** Migration begins.

To view the progress of a migration, click the icon for that logical drive in the **Configuration View** window. A **More Information** popup window is displayed that lists the drive status.

Spare Management

NOTE: An array can have more than one spare, and a spare can be shared by several arrays.

1. Click **Spare Management,** and then click **Begin**.
2. Select the array for which you would like to change the assigned spares.
3. Select the spares you would like to assign to the array and deselect any spares that you would like to remove from the array. Click **Next**.
4. Click **Finish** to accept the changes.
5. Click **Save** to apply the changes to the system, and then click **OK** on the confirmation alert.

Selective Storage Presentation (SSP) - for RA4X00 Controllers Only

This menu option lets you forbid selected host controllers from accessing a logical drive. This prevents data corruption that may occur when different servers using different operating systems access the same data.

1. Click **Selective Storage Presentation,** and then click **Begin.**

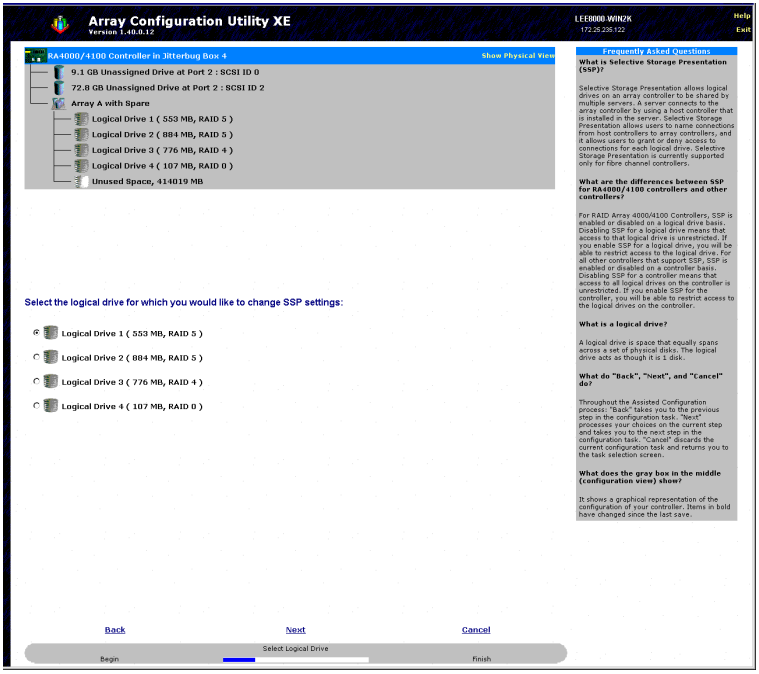

Array Configuration Utility XE
Version 1.40.0.12
LEEBOOB-WIN2K
172.25.235.122
Help
Exit
RA4000/4100 Controller in Jitterbug Box 4
Show Physical View
9.1 GB Unassigned Drive at Port 2 : SCSI ID 0
72.8 GB Unassigned Drive at Port 2 : SCSI ID 2
Array A with Spare
Logical Drive 1 (553 MB, RAID 5)
Logical Drive 2 (884 MB, RAID 5)
Logical Drive 3 (776 MB, RAID 4)
Logical Drive 4 (107 MB, RAID 0)
Unused Space, 414019 MB
Frequently Asked Questions
What is Selective Storage Presentation (SSP)?
Selective Storage Presentation allows logical drives on an array controller to be shared by multiple servers. A server connects to the array controller by using a host controller that is installed in the server. Selective Storage Presentation allows users to name connections from host controllers to array controllers, and it allows users to grant or deny access to connections for each logical drive. Selective Storage Presentation is currently supported only for fibre channel controllers.
What are the differences between SSP for RA4000/4100 controllers and other controllers?
For RAID Array 4000/4100 Controllers, SSP is enabled or disabled on a logical drive basis. Disabling SSP for a logical drive means that access to that logical drive is unrestricted. If you enable SSP for a logical drive, you will be able to restrict access to the logical drive. For all other controllers that support SSP, SSP is enabled or disabled on a controller basis. Disabling SSP for a controller means that access to all logical drives on the controller is unrestricted. If you enable SSP for the controller, you will be able to restrict access to the logical drives on the controller.
What is a logical drive?
A logical drive is space that equally spans across a set of physical disks. The logical drive acts as though it is 1 disk.
What do "Back", "Next", and "Cancel" do?
Throughout the Assisted Configuration process: "Back" takes you to the previous step in the configuration task. "Next" processes your choices on the current step and takes you to the next step in the configuration task. "Cancel" discards the current configuration task and returns you to the task selection screen.
What does the gray box in the middle (configuration view) show?
It shows a graphical representation of the configuration of your controller. Items in bold have changed since the last save.
Select the logical drive for which you would like to change SSP settings:
Logical Drive 1 (553 MB, RAID 5)
Logical Drive 2 (884 MB, RAID 5)
Logical Drive 3 (776 MB, RAID 4)
Logical Drive 4 (107 MB, RAID 0)
Back
Next
Cancel
Select Logical Drive
Begin
Finish

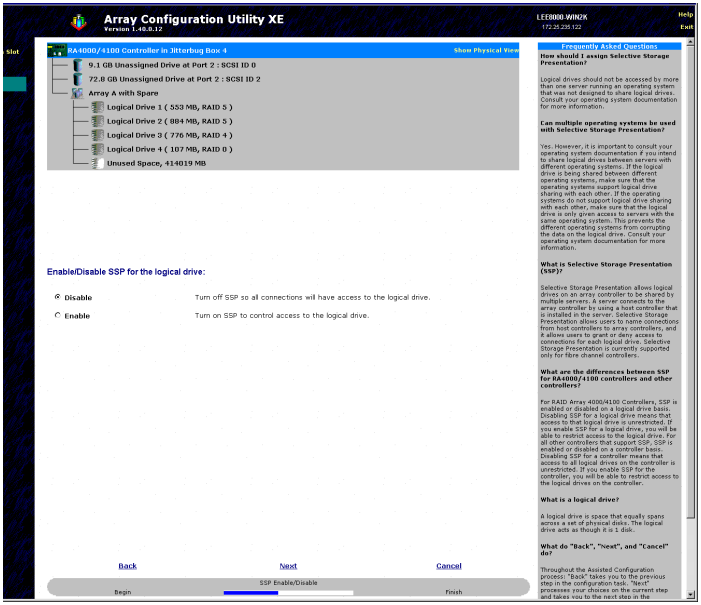
Figure 3-1: Selective Service Presentation Logical Drive selection screen

2. Select the logical drive for which you want to change the access settings, and then click **Next.**

   A screen is displayed that lets you enable or disable the access settings.

   — Disabling the access settings lets all host controllers gain access to the selected logical drive.

   — Enabling the settings lets you deny access to selected hosts.


Array Configuration Utility XE
Version 1.45.0.12
LEE8080-WIN2K
172.25.235.122
Help
Exit
RA4000/4100 Controller in Jitterbug Box 4
Show Physical View
9.1 GB Unassigned Drive at Port 2 : SCSI ID 0
72.8 GB Unassigned Drive at Port 2 : SCSI ID 2
Array A with Spare
Logical Drive 1 (553 MB, RAID 5)
Logical Drive 2 (884 MB, RAID 5)
Logical Drive 3 (776 MB, RAID 4)
Logical Drive 4 (107 MB, RAID 0)
Unused Space, 414019 MB
Enable/Disable SSP for the logical drive:
Disable
Turn off SSP so all connections will have access to the logical drive.
Enable
Turn on SSP to control access to the logical drive.
Back
Next
Cancel
SSP Enable/Disable
Begin
Finish
Frequently Asked Questions
How should I assign Selective Storage Presentation?
Logical drives should not be accessed by more than one server running an operating system that was not designed to share logical drives. Consult your operating system documentation for more information.
Can multiple operating systems be used with Selective Storage Presentation?
Yes. However, it is important to consult your operating system documentation if you intend to share logical drives between servers with different operating systems. If the logical drive is being shared between different operating systems, make sure that the operating systems support logical drive sharing with each other. If the operating systems do not support logical drive sharing with each other, make sure that the logical drive is only given access to servers with the same operating system. This prevents the different operating systems from corrupting the data on the logical drive. Consult your operating system documentation for more information.
What is Selective Storage Presentation (ssp)?
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What are the differences between SSP for RA4000/4100 controllers and other controllers?
For RAID Array 4000/4100 Controllers, SSP is enabled or disabled on a logical drive basis. Disabling SSP for a logical drive means that access to that logical drive is unrestricted. If you enable SSP for a logical drive, you will be able to restrict access to the logical drive. For all other controllers that support SSP, SSP is enabled or disabled on a controller basis. Disabling SSP for a controller means that access to all logical drives on the controller is unrestricted. If you enable SSP for a controller, you will be able to restrict access to the logical drives on the controller.
What is a logical drive?
A logical drive is space that equally spans across a set of physical disks. The logical drive acts as though it is 1 disk.
What do "Back", "Next", and "Cancel" do?
Throughout the Assisted Configuration process: "Back" takes you to the previous step in the configuration task. "Next" processes your choices on the current step and takes you to the next step in the

Figure 3-2: Enable or Disable settings screen

3. Select **Disable** or **Enable,** and then click **Next.**

If you enable the access settings, the screen lists all identified host controllers. Select the host controllers that are to have access to the logical drive, rename the connections if necessary, and then click **Next.**

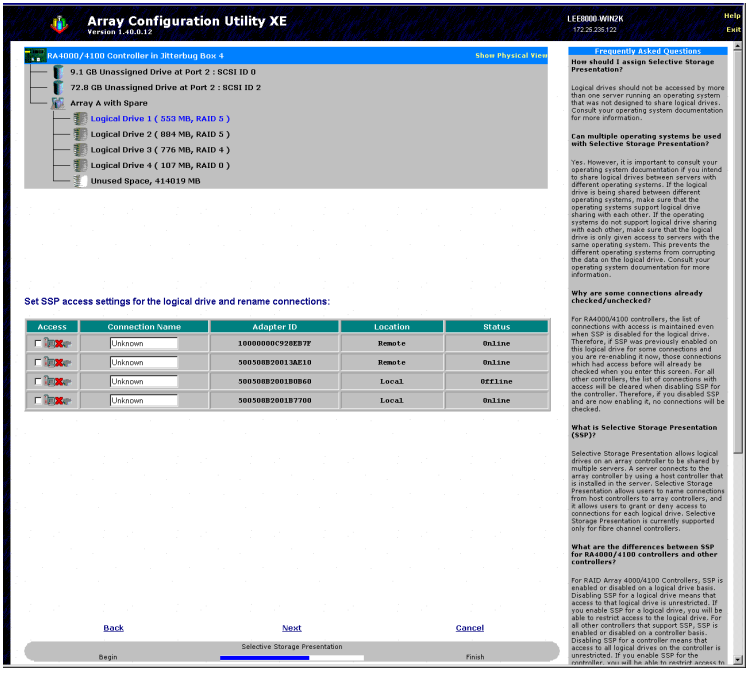
Array Configuration Utility XE
Version 1.40.0.12
LEE0000 WIN2K
172.28.236.122
Help
Exit
RA4000/4100 Controller in Jitterbug Box 4
Show Physical View
9.1 GB Unassigned Drive at Port 2 : SCSI ID 0
72.8 GB Unassigned Drive at Port 2 : SCSI ID 2
Array A with Spare
Logical Drive 1 (553 MB, RAID 5)
Logical Drive 2 (884 MB, RAID 5)
Logical Drive 3 (776 MB, RAID 4)
Logical Drive 4 (107 MB, RAID 0)
Unused Space, 414019 MB
Set SSP access settings for the logical drive and rename connections:
Access
Connection Name
Adapter ID
Location
Status
Unknown
10000000C920EB7F
Remote
Online
Unknown
500508B20013AE10
Remote
Online
Unknown
500508B2001B0B60
Local
Offline
Unknown
500508B2001B7700
Local
Online
Back
Next
Cancel
Selective Storage Presentation
Begin
Finish
Frequently Asked Questions
How should I assign Selective Storage Presentation?
Logical drives should not be accessed by more than one server running an operating system that was not designed to share logical drives. Consult your operating system documentation for more information.
Can multiple operating systems be used with Selective Storage Presentation?
Yes. However, it is important to consult your operating system documentation if you intend to share logical drives between servers with different operating systems. If the logical drive is being shared between different operating systems, make sure that the operating systems support logical drive sharing with each other. If the operating systems do not support logical drive sharing with each other, make sure that the logical drive is only given access to servers with the same operating system. This prevents the different operating systems from corrupting the data on the logical drive. Consult your operating system documentation for more information.
Why are some connections already checked/unchecked?
For RA4000/4100 controllers, the list of connections with access is maintained even when SSP is disabled for the logical drive. Therefore, if SSP was previously enabled on this logical drive for some connections and you are re-enabling it now, those connections which had access before will already be checked when you enter this screen. For all other controllers, the list of connections with access will be cleared when disabling SSP for the controller. Therefore, if you disabled SSP and are now enabling it, no connections will be checked.
What is Selective Storage Presentation (SSP)?
Selective Storage Presentation allows logical drives on an array controller to be shared by multiple servers. A server connects to the array controller by using a host controller that is installed in the server. Selective Storage Presentation allows users to name connections from host controllers to array controllers, and it allows users to grant or deny access to connections for each logical drive. Selective Storage Presentation is currently supported only for fibre channel controllers.
What are the differences between SSP for RA4000/4100 controllers and other controllers?
For RAID Array 4000/4100 Controllers, SSP is enabled or disabled on a logical drive basis. Disabling SSP for a logical drive means that access to that logical drive is unrestricted. If you enable SSP for a logical drive, you will be able to restrict access to the logical drive. For all other controllers that support SSP, SSP is enabled or disabled on a controller basis. Disabling SSP for a controller means that access to all logical drives on the controller is unrestricted. If you enable SSP for the

Figure 3-3: SSP settings screen

4. Click **Finish.**

Selective Storage Presentation (SSP) - for MSA 1000 Controllers Only

1. Access the logical drive screen (refer to the section, “Creating a Logical Drive,” in Chapter 2 of this guide.)

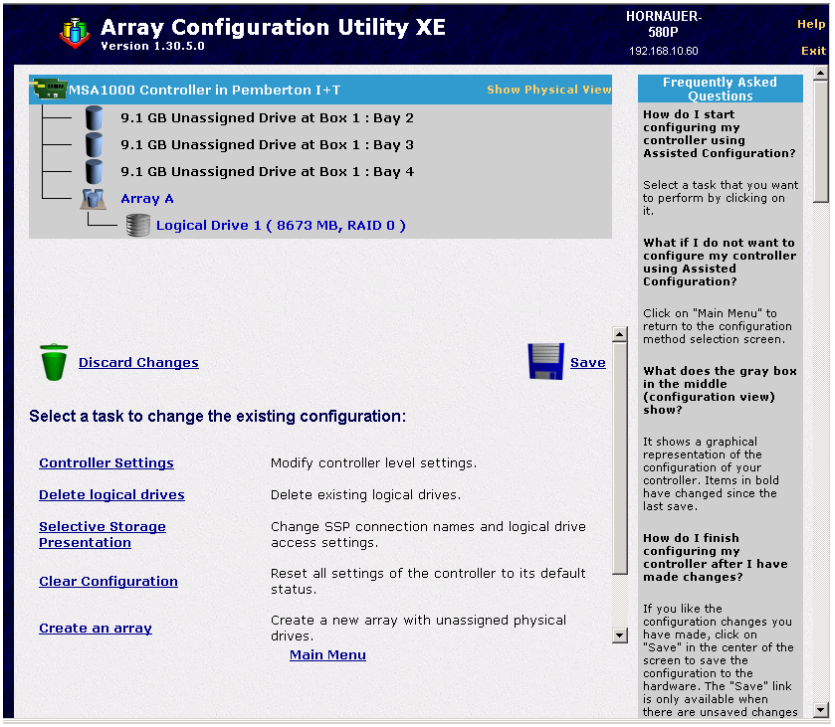
Array Configuration Utility XE
Version 1.30.5.0
HORNAUER-580P
192.168.10.60
Help
Exit
MSA1000 Controller in Pemberton I+T
Show Physical View
9.1 GB Unassigned Drive at Box 1 : Bay 2
9.1 GB Unassigned Drive at Box 1 : Bay 3
9.1 GB Unassigned Drive at Box 1 : Bay 4
Array A
Logical Drive 1 (8673 MB, RAID 0)
Discard Changes
Save
Select a task to change the existing configuration:
Controller Settings
Modify controller level settings.
Delete logical drives
Delete existing logical drives.
Selective Storage Presentation
Change SSP connection names and logical drive access settings.
Clear Configuration
Reset all settings of the controller to its default status.
Create an array
Create a new array with unassigned physical drives.
Main Menu
Frequently Asked Questions
How do I start configuring my controller using Assisted Configuration?
Select a task that you want to perform by clicking on it.
What if I do not want to configure my controller using Assisted Configuration?
Click on "Main Menu" to return to the configuration method selection screen.
What does the gray box in the middle (configuration view) show?
It shows a graphical representation of the configuration of your controller. Items in bold have changed since the last save.
How do I finish configuring my controller after I have made changes?
If you like the configuration changes you have made, click on "Save" in the center of the screen to save the configuration to the hardware. The "Save" link is only available when there are unsaved changes

Figure 3-4: Logical drive screen

2. Click **Selective Storage Presentation,** and then click **Begin.**

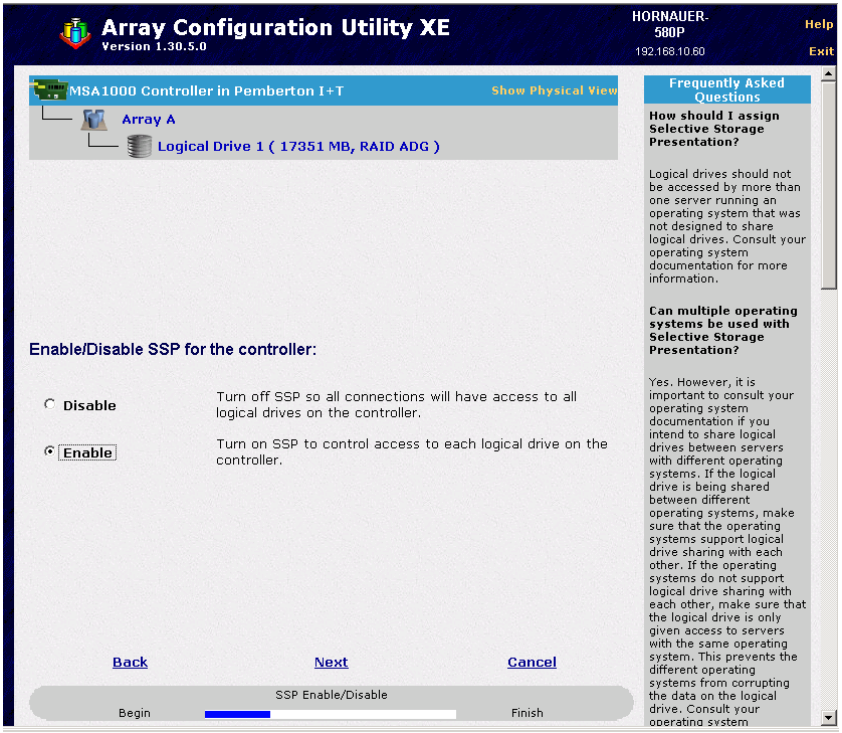
Array Configuration Utility XE
Version 1.30.5.0
HORNAUER-580P
192.168.10.60
Help
Exit
MSA1000 Controller in Pemberton I+T
Show Physical View
Array A
Logical Drive 1 (17351 MB, RAID ADG)
Frequently Asked Questions
How should I assign Selective Storage Presentation?
Logical drives should not be accessed by more than one server running an operating system that was not designed to share logical drives. Consult your operating system documentation for more information.
Can multiple operating systems be used with Selective Storage Presentation?
Yes. However, it is important to consult your operating system documentation if you intend to share logical drives between servers with different operating systems. If the logical drive is being shared between different operating systems, make sure that the operating systems support logical drive sharing with each other. If the operating systems do not support logical drive sharing with each other, make sure that the logical drive is only given access to servers with the same operating system. This prevents the different operating systems from corrupting the data on the logical drive. Consult your
Enable/Disable SSP for the controller:
Disable
Turn off SSP so all connections will have access to all logical drives on the controller.
Enable
Turn on SSP to control access to each logical drive on the controller.
Back
Next
Cancel
SSP Enable/Disable
Begin
Finish

Figure 3-5: Selective Storage Presentation screen

A screen is displayed that lets you enable or disable the access settings.

- Disabling the access setting lets all host controllers access all selected logical drives; enabling the settings allows you to deny access to selected hosts.
- If you enable the access settings, a screen listing all identified host controllers is displayed.

3. Enable or disable SSP.

4. If you are enabling, assign host access to each logical drive that is appropriate by reviewing the corresponding drive in the **Selective Storage Presentation Settings.** Refer to the figure below as an example.
5. Click **Next.**

NOTE: If **Selective Storage Presentation** is enabled, a warning displays concerning restricted Logical Drive access.

6. Click **Finish**.

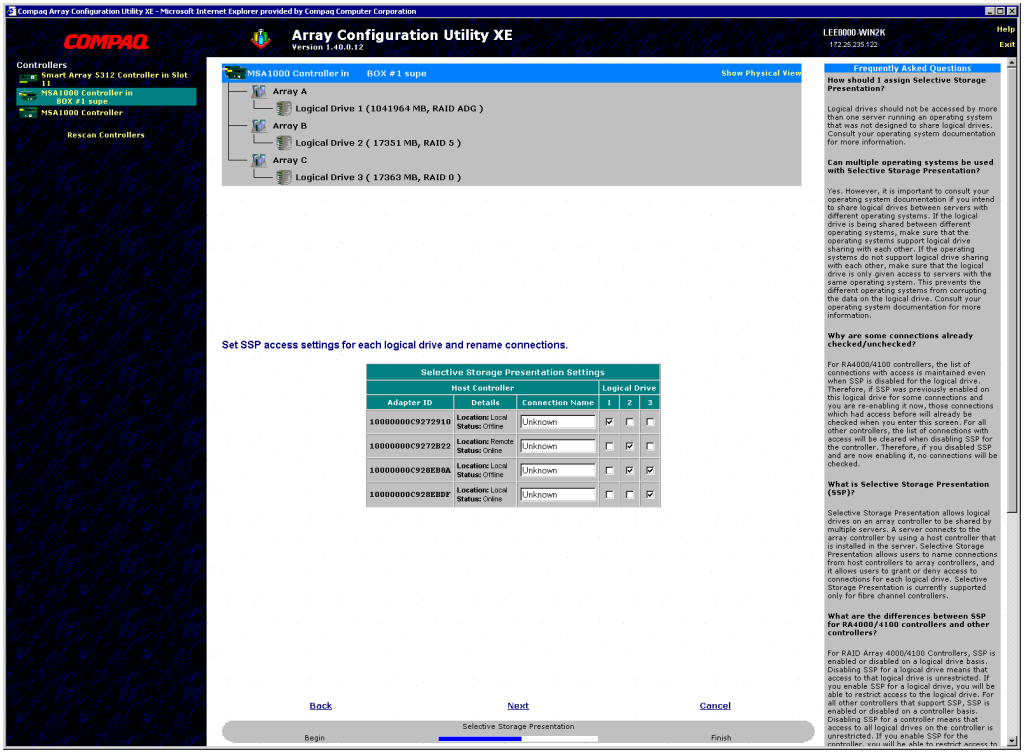
Compaq Array Configuration Utility XE - Microsoft Internet Explorer provided by Compaq Computer Corporation
COMPAQ
Array Configuration Utility XE
Version 1.40.0.12
LEE0000-WIN2K
172.25.235.122
Help
Exit
Controllers
Smart Array 5312 Controller in Slot 11
MSA1000 Controller in BOX #1 supe
MSA1000 Controller
Rescan Controllers
MSA1000 Controller in BOX #1 supe
Show Physical View
Array A
Logical Drive 1 (1041964 MB, RAID ADG)
Array B
Logical Drive 2 (17351 MB, RAID 5)
Array C
Logical Drive 3 (17363 MB, RAID 0)
Frequently Asked Questions
How should I assign Selective Storage Presentation?
Logical drives should not be accessed by more than one server running an operating system that was not designed to share logical drives. Consult your operating system documentation for more information.
Can multiple operating systems be used with Selective Storage Presentation?
Yes. However, it is important to consult your operating system documentation if you intend to share logical drives between servers with different operating systems. If the logical drive is being shared between different operating systems, make sure that the operating systems support logical drive sharing with each other. If the operating systems do not support logical drive sharing with each other, make sure that the logical drive is only given access to servers with the same operating system. This prevents the different operating systems from corrupting the data on the logical drive. Consult your operating system documentation for more information.
Why are some connections already checked/unchecked?
For RA4000/4100 controllers, the list of connections with access is maintained even when SSP is disabled for the logical drive. Therefore, if SSP was previously enabled on this logical drive for some connections and you are re-enabling it now, those connections which had access before will already be checked when you enter this screen. For all other controllers, the list of connections with access will be cleared when disabling SSP for the controller. Therefore, if you disabled SSP and are now enabling it, no connections will be checked.
What is Selective Storage Presentation (SSP)?
Selective Storage Presentation allows logical drives on an array controller to be shared by multiple servers. A server connects to the array controller by using a host controller that is installed in the server. Selective Storage Presentation allows users to name connections from host controllers to array controllers, and it allows users to grant or deny access to connections for each logical drive. Selective Storage Presentation is currently supported only for fibre channel controllers.
What are the differences between SSP for RA4000/4100 controllers and other controllers?
For RAID Array 4000/4100 Controllers, SSP is enabled or disabled on a logical drive basis. Disabling SSP for a logical drive means that access to that logical drive is unrestricted. If you enable SSP for a logical drive, you will be able to restrict access to the logical drive. For all other controllers that support SSP, SSP is enabled or disabled on a controller basis. Disabling SSP for a controller means that access to all logical drives on the controller is unrestricted. If you enable SSP for the
Set SSP access settings for each logical drive and rename connections.
Selective Storage Presentation Settings
Host Controller
Logical Drive
Adapter ID
Details
Connection Name
1
2
3
10000000C9272910
Location: Local
Status: Offline
Unknown
10000000C9272B22
Location: Remote
Status: Online
Unknown
10000000C928EB0A
Location: Local
Status: Offline
Unknown
10000000C928EBDF
Location: Local
Status: Online
Unknown
Back
Next
Cancel
Selective Storage Presentation
Begin
Finish

Figure 3-6: SSP settings screen

Advanced Configuration Mode

1. Click **Advanced Configuration**. The advanced mode start screen is displayed.

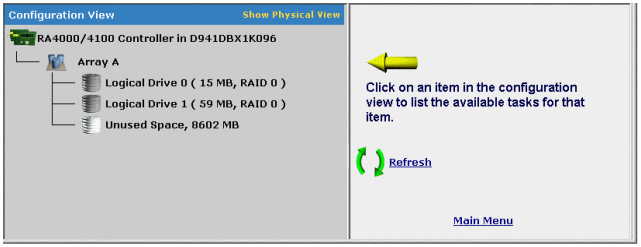
Configuration View
Show Physical View
RA4000/4100 Controller in D941DBX1K096
Array A
Logical Drive 0 (15 MB, RAID 0)
Logical Drive 1 (59 MB, RAID 0)
Unused Space, 8602 MB
Click on an item in the configuration view to list the available tasks for that item.
Refresh
Main Menu

Figure 3-7: Advanced mode start screen

2. Click an item in the **Configuration View** window. The screen displays a list of the tasks that are available for that item.

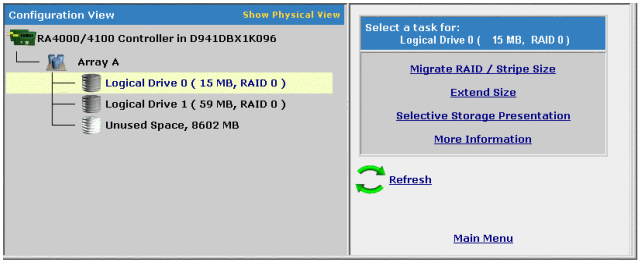
Configuration View
Show Physical View
RA4000/4100 Controller in D941DBX1K096
Array A
Logical Drive 0 (15 MB, RAID 0)
Logical Drive 1 (59 MB, RAID 0)
Unused Space, 8602 MB
Select a task for:
Logical Drive 0 (15 MB, RAID 0)
Migrate RAID / Stripe Size
Extend Size
Selective Storage Presentation
More Information
Refresh
Main Menu

Figure 3-8: Typical task list for a logical drive

The listed (available) tasks are a subset of the total number of tasks that are possible for the selected item. Which of the possible tasks are listed for an item and which are omitted depends on the current controller configuration and model. (For example, **Create Array** is not an available task for a controller item if there are no unassigned physical drives connected to the controller.) Table 3-2 lists all the possible tasks for every type of item.

The **More Information** task is present for all items except unused space. Clicking the link for this task causes a popup window to display with additional information about the selected item. Refer to the "Description of Screen Regions" section in Chapter 1 for an example of this type of screen.

Table 3-2: Possible Tasks in Advanced Configuration Mode

Item	Available Tasks
Controller	Clear Configuration
	Controller Settings
	Create Array
	Logical Drive Array Accelerator Settings
	More Information
	Selective Storage Presentation (on MSA1000 controllers)
Array	Create Logical Drive
	Delete
	Expand
	Spare Management
	More Information
Logical drive	Delete
	Extend Size
	Migrate RAID / Stripe Size
	Selective Storage Presentation (on RA4x00 controllers)
	More Information
Unused space	(No available tasks associated with this item)

3. Click a task link. A list of all possible configuration options for that task is displayed on the right-hand side of the screen (replacing the task list). Refer to the "Description of Screen Regions" section in Chapter 1 for an example of this type of screen.
4. Set the configuration options.
5. Click **OK**.

Modular SAN Array (MSA) Fabric Switch 6 Configuration Overview

NOTE: The Switch Configuration Link is present only if the selected controller supports this feature.

In order to properly configure your MSA Fabric Switch 6, you are prompted by specific screens to fill in information. You will have a chance to review your choices and make changes before they are saved.

Startup Screen

When ACU-XE is started, an MSA 1000 controller must be selected from the left column of the initial screen to show different method options available on the bottom scroll window, as shown in Figure 3-9.

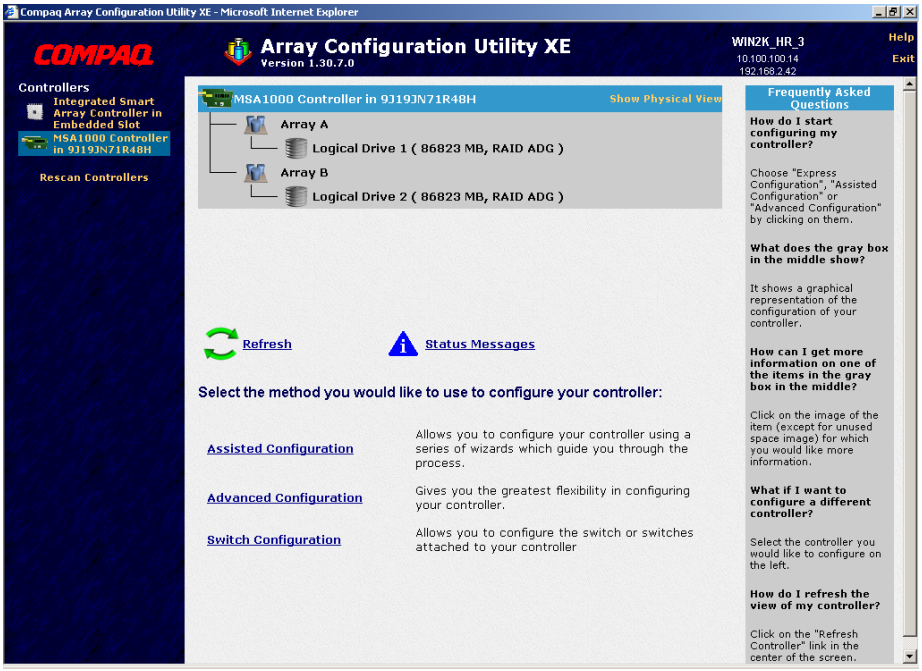
Compaq Array Configuration Utility XE - Microsoft Internet Explorer
COMPAQ
Array Configuration Utility XE
Version 1.30.7.0
WIN2K_HR_3
10.100.100.14
192.168.2.42
Help
Exit
Controllers
Integrated Smart Array Controller in Embedded Slot
MSA1000 Controller in 9J19JN71R48H
Rescan Controllers
MSA1000 Controller in 9J19JN71R48H
Show Physical View
Array A
Logical Drive 1 (86823 MB, RAID ADG)
Array B
Logical Drive 2 (86823 MB, RAID ADG)
Refresh
Status Messages
Select the method you would like to use to configure your controller:
Assisted Configuration
Allows you to configure your controller using a series of wizards which guide you through the process.
Advanced Configuration
Gives you the greatest flexibility in configuring your controller.
Switch Configuration
Allows you to configure the switch or switches attached to your controller
Frequently Asked Questions
How do I start configuring my controller?
Choose "Express Configuration", "Assisted Configuration" or "Advanced Configuration" by clicking on them.
What does the gray box in the middle show?
It shows a graphical representation of the configuration of your controller.
How can I get more information on one of the items in the gray box in the middle?
Click on the image of the item (except for unused space image) for which you would like more information.
What if I want to configure a different controller?
Select the controller you would like to configure on the left.
How do I refresh the view of my controller?
Click on the "Refresh Controller" link in the center of the screen.

Figure 3-9: ACU-XE initial screen

Switch Configuration View

Selecting **Switch Configuration** opens the switch selection screen, as shown in Figure 3-10. This screen displays the available switches detected by ACU-XE. In Figure 3-10, two switches are detected.

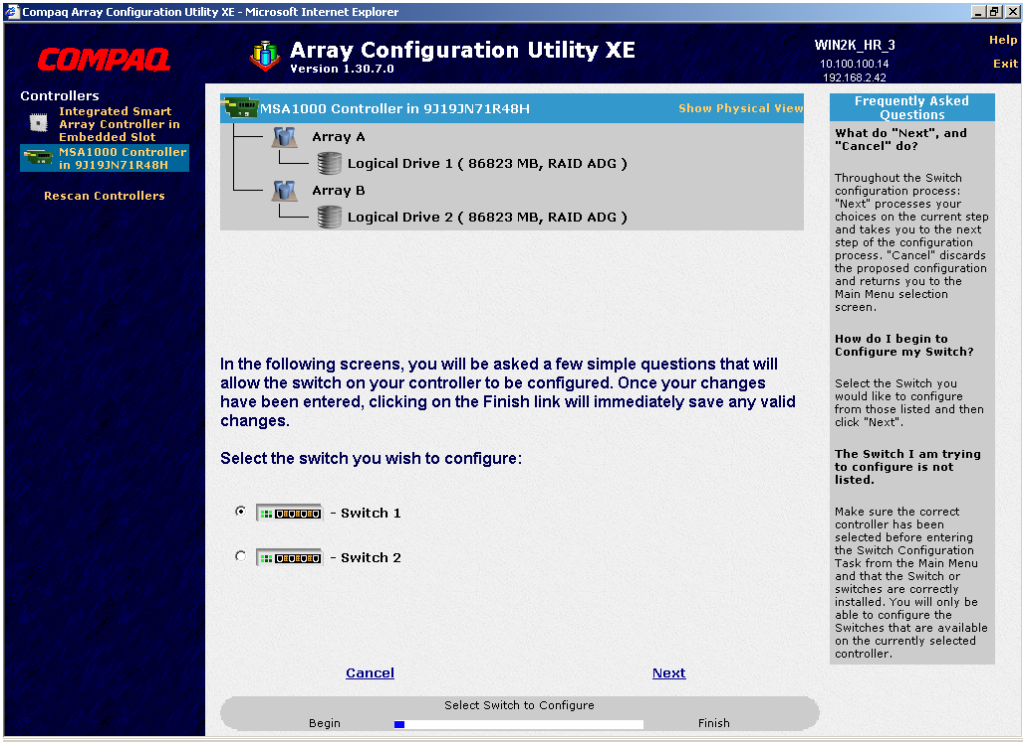
Compaq Array Configuration Utility XE - Microsoft Internet Explorer
COMPAQ
Array Configuration Utility XE
Version 1.30.7.0
WIN2K_HR_3
10.100.100.14
192.168.2.42
Help
Exit
Controllers
Integrated Smart Array Controller in Embedded Slot
MSA1000 Controller in 9J19JN71R48H
Rescan Controllers
MSA1000 Controller in 9J19JN71R48H
Show Physical View
Array A
Logical Drive 1 (86823 MB, RAID ADG)
Array B
Logical Drive 2 (86823 MB, RAID ADG)
In the following screens, you will be asked a few simple questions that will allow the switch on your controller to be configured. Once your changes have been entered, clicking on the Finish link will immediately save any valid changes.
Select the switch you wish to configure:
- Switch 1
- Switch 2
Cancel
Next
Select Switch to Configure
Begin
Finish
Frequently Asked Questions
What do "Next", and "Cancel" do?
Throughout the Switch configuration process: "Next" processes your choices on the current step and takes you to the next step of the configuration process. "Cancel" discards the proposed configuration and returns you to the Main Menu selection screen.
How do I begin to Configure my Switch?
Select the Switch you would like to configure from those listed and then click "Next".
The Switch I am trying to configure is not listed.
Make sure the correct controller has been selected before entering the Switch Configuration Task from the Main Menu and that the Switch or switches are correctly installed. You will only be able to configure the Switches that are available on the currently selected controller.

Figure 3-10: Switch selection screen

Select one switch at a time to configure. ACU-XE displays only the switches available for configuration on the currently selected controllers(s).

Select Method Before Initial Setup View

In the select method before initial setup view, the **Switch Configuration Task** option prompts you to select the specific method to configure your switch. ACU-XE offers only one option to perform the ACU-XE switch configuration at initial installation. This option is presented with a warning that explains why only one option is presented and the steps to follow if another option is desired.

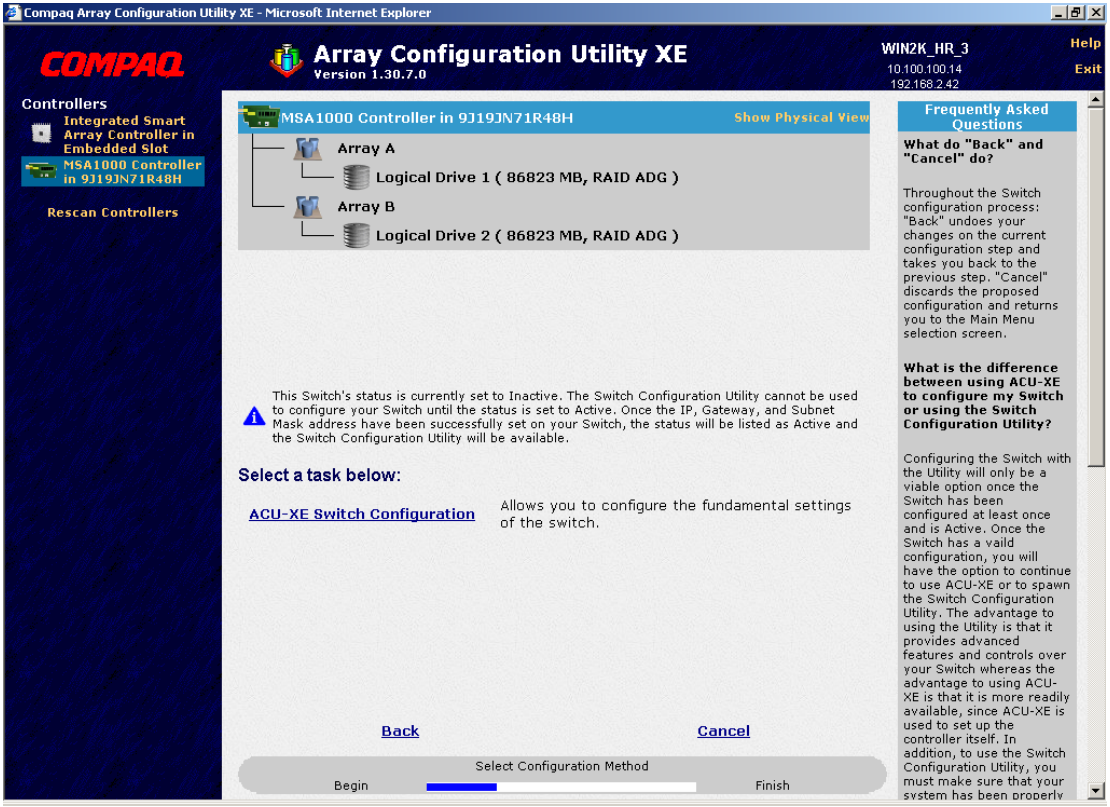
Compaq Array Configuration Utility XE - Microsoft Internet Explorer
COMPAQ
Array Configuration Utility XE
Version 1.30.7.0
WIN2K_HR_3
10.100.100.14
192.168.2.42
Help
Exit
Controllers
Integrated Smart Array Controller in Embedded Slot
MSA1000 Controller in 9J19JN71R48H
Rescan Controllers
MSA1000 Controller in 9J19JN71R48H
Show Physical View
Array A
Logical Drive 1 (86823 MB, RAID ADG)
Array B
Logical Drive 2 (86823 MB, RAID ADG)
Frequently Asked Questions
What do "Back" and "Cancel" do?
Throughout the Switch configuration process: "Back" undoes your changes on the current configuration step and takes you back to the previous step. "Cancel" discards the proposed configuration and returns you to the Main Menu selection screen.
What is the difference between using ACU-XE to configure my Switch or using the Switch Configuration Utility?
Configuring the Switch with the Utility will only be a viable option once the Switch has been configured at least once and is Active. Once the Switch has a vaild configuration, you will have the option to continue to use ACU-XE or to spawn the Switch Configuration Utility. The advantage to using the Utility is that it provides advanced features and controls over your Switch whereas the advantage to using ACU-XE is that it is more readily available, since ACU-XE is used to set up the controller itself. In addition, to use the Switch Configuration Utility, you must make sure that your system has been properly
This Switch's status is currently set to Inactive. The Switch Configuration Utility cannot be used to configure your Switch until the status is set to Active. Once the IP, Gateway, and Subnet Mask address have been successfully set on your Switch, the status will be listed as Active and the Switch Configuration Utility will be available.
Select a task below:
ACU-XE Switch Configuration
Allows you to configure the fundamental settings of the switch.
Back
Cancel
Select Configuration Method
Begin
Finish

Figure 3-11: Select method before initial setup view

Switch Parameters View

Once a switch is selected, the **Switch Configuration Task** option allows you to view current parameters of the switch, and to set new values for the switch.

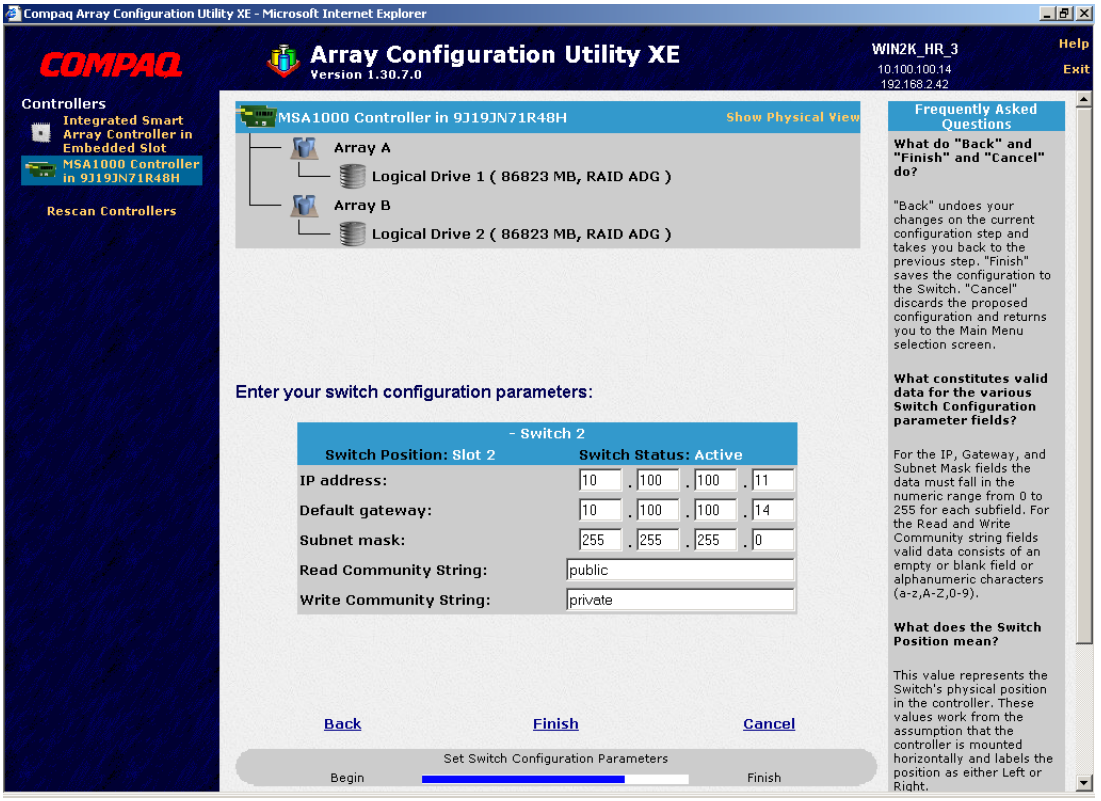
Compaq Array Configuration Utility XE - Microsoft Internet Explorer
COMPAQ
Array Configuration Utility XE
Version 1.30.7.0
WIN2K_HR_3
10.100.100.14
192.168.2.42
Help
Exit
Controllers
Integrated Smart Array Controller in Embedded Slot
MSA1000 Controller in 9J19JN71R48H
Rescan Controllers
MSA1000 Controller in 9J19JN71R48H
Show Physical View
Array A
Logical Drive 1 (86823 MB, RAID ADG)
Array B
Logical Drive 2 (86823 MB, RAID ADG)
Enter your switch configuration parameters:
- Switch 2
Switch Position: Slot 2
Switch Status: Active
IP address: 10 . 100 . 100 . 11
Default gateway: 10 . 100 . 100 . 14
Subnet mask: 255 . 255 . 255 . 0
Read Community String: public
Write Community String: private
Back
Finish
Cancel
Set Switch Configuration Parameters
Begin
Finish
Frequently Asked Questions
What do "Back" and "Finish" and "Cancel" do?
"Back" undoes your changes on the current configuration step and takes you back to the previous step. "Finish" saves the configuration to the Switch. "Cancel" discards the proposed configuration and returns you to the Main Menu selection screen.
What constitutes valid data for the various Switch Configuration parameter fields?
For the IP, Gateway, and Subnet Mask fields the data must fall in the numeric range from 0 to 255 for each subfield. For the Read and Write Community string fields valid data consists of an empty or blank field or alphanumeric characters (a-z,A-Z,0-9).
What does the Switch Position mean?
This value represents the Switch's physical position in the controller. These values work from the assumption that the controller is mounted horizontally and labels the position as either Left or Right.

Figure 3-12: Switch parameters view

Input the IP address, subnet mask, and default gateway information. The default Read and Write Community strings are shown. Change these community strings to match your network or leave the default setting. Click **Finish** to save the settings. Repeat these steps for the other switch(es) detected. When you are finished, click **Finish** to return to the main screen.

Select Method After Initial Setup View

You may choose to use the Switch Configuration Utility embedded on the switch firmware. The Switch Configuration Utility is activated by configuring the switch IP address, subnet mask, and default gateway with the **Switch Configuration Task** option. Completion of the Switch Configuration Task sets the switch to Active and allows the utility to appear as an option link on the screen, as shown in Figure 3-13. In addition to the parameters offered by ACU-XE, more advanced parameters can be configured with the Switch Configuration Utility through a web browser.

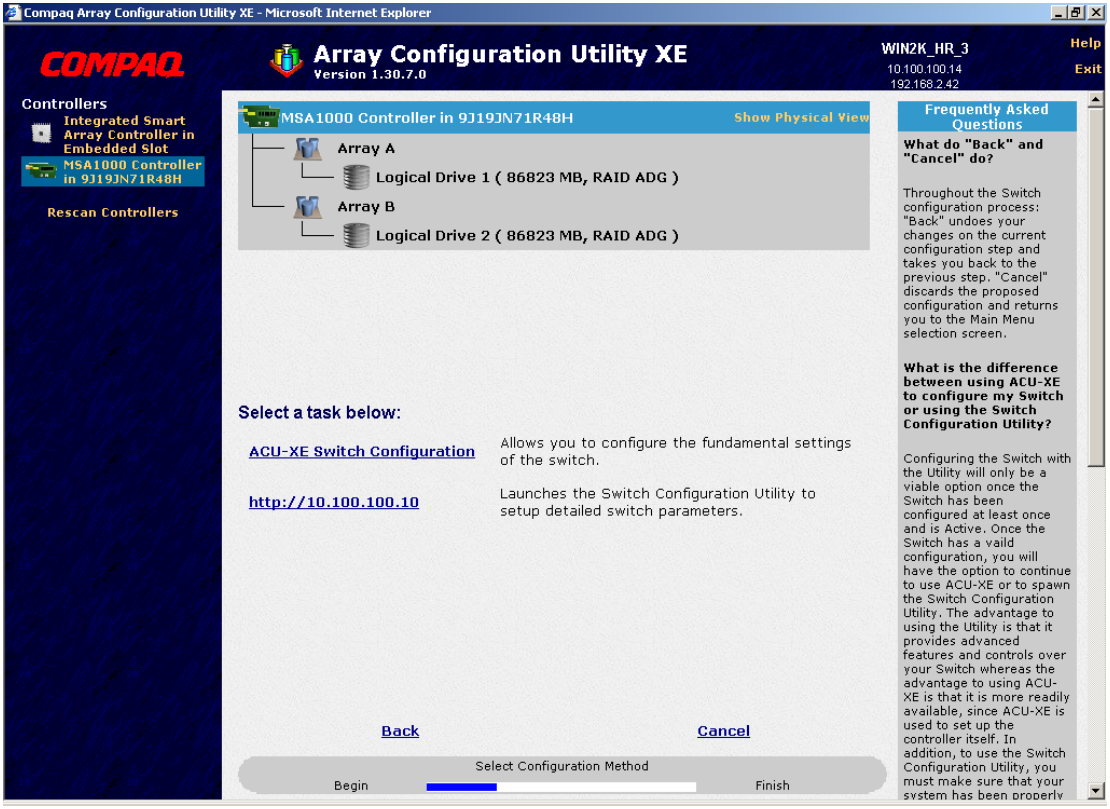
Compaq Array Configuration Utility XE - Microsoft Internet Explorer
COMPAQ
Array Configuration Utility XE
Version 1.30.7.0
WIN2K_HR_3
10.100.100.14
192.168.2.42
Help
Exit
Controllers
Integrated Smart Array Controller in Embedded Slot
MSA1000 Controller in 9J19JN71R48H
Rescan Controllers
MSA1000 Controller in 9J19JN71R48H
Show Physical View
Array A
Logical Drive 1 (86823 MB, RAID ADG)
Array B
Logical Drive 2 (86823 MB, RAID ADG)
Frequently Asked Questions
What do "Back" and "Cancel" do?
Throughout the Switch configuration process: "Back" undoes your changes on the current configuration step and takes you back to the previous step. "Cancel" discards the proposed configuration and returns you to the Main Menu selection screen.
What is the difference between using ACU-XE to configure my Switch or using the Switch Configuration Utility?
Configuring the Switch with the Utility will only be a viable option once the Switch has been configured at least once and is Active. Once the Switch has a vaild configuration, you will have the option to continue to use ACU-XE or to spawn the Switch Configuration Utility. The advantage to using the Utility is that it provides advanced features and controls over your Switch whereas the advantage to using ACU-XE is that it is more readily available, since ACU-XE is used to set up the controller itself. In addition, to use the Switch Configuration Utility, you must make sure that your system has been properly
Select a task below:
ACU-XE Switch Configuration
Allows you to configure the fundamental settings of the switch.
http://10.100.100.10
Launches the Switch Configuration Utility to setup detailed switch parameters.
Back
Cancel
Select Configuration Method
Begin
Finish

Figure 3-13: Select method after initial setup view

Selecting the IP address of the switch brings up a Windows-supported browser containing a Java Applet window for further configuration of the switch.

NOTE: In order for the Web-based Switch Configuration Utility screen to display successfully, a newer Java plug-in may be required to be loaded on your system.

NOTE: Before using the Web-based Switch Configuration Utility screen, be sure that the networking cables have been connected between the management computer running ACU-XE and the LAN management ports on the switch(es), usually through a hub. The use of the `PING` command is recommended to ensure connectivity before proceeding with the Switch Configuration Utility link.

A

Drive Arrays and Fault Tolerance

What Is a Drive Array?

The capacity and performance of a single physical (hard) drive is adequate for home users. However, business users demand higher storage capacities, higher data transfer rates, and greater protection against data loss when drives fail.

Merely adding extra physical drives to the system increases the total storage capacity (refer to Figure A-1). However, this addition does not affect the efficiency of read/write (R/W) operations, since data can still only be transferred to one physical drive at a time.

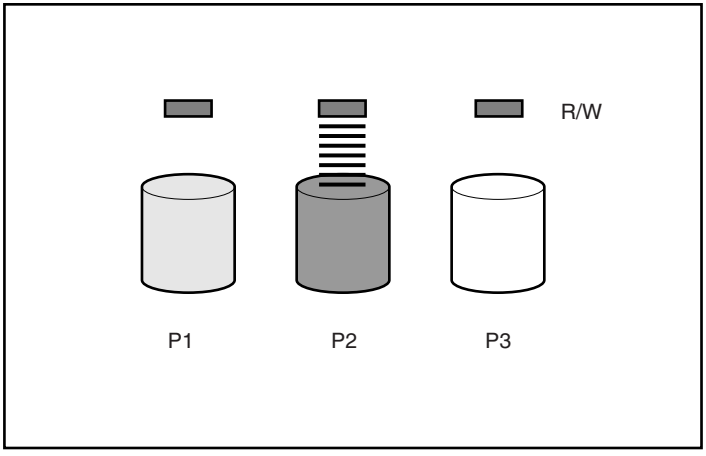

Figure A-1: Physical drives added to system

With an array controller installed in the system, the capacity of several physical drives can be combined into one or more virtual units termed **logical drives** (also called logical volumes). Then, the read/write heads of all the constituent physical drives are active simultaneously, reducing the total time required for data transfer.

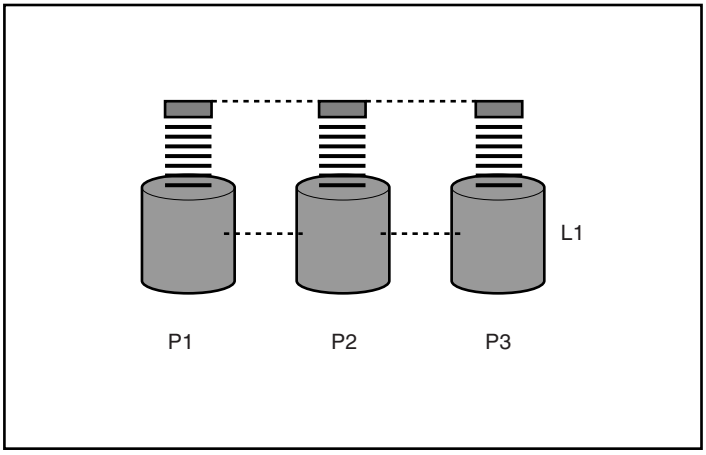

Figure A-2: Physical drives configured into a logical drive (L1)

Because the read/write heads are active simultaneously, the same amount of data is written to each drive during any given time interval. Each unit of data is termed a **block,** and over all the physical drives in a logical drive the blocks form a set of data **stripes** (refer to Figure A-3).

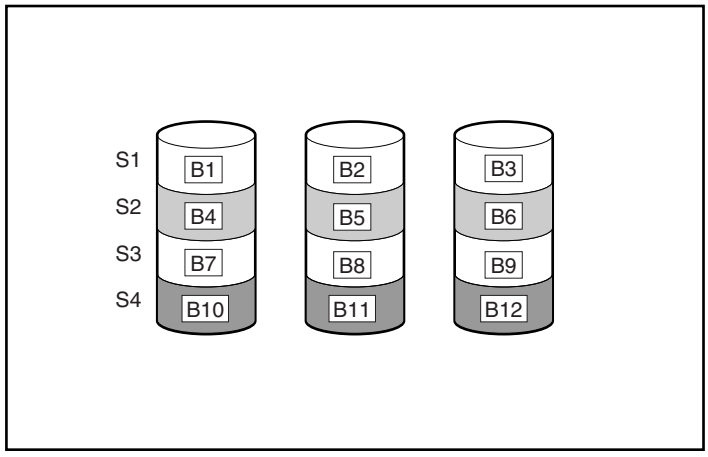

Figure A-3: Data striping (S1-S4) of data blocks B1-B12

For data in the logical drive to be readable, the data block sequence must be the same in every stripe. This sequencing process is performed by the array controller, which sends the data blocks to the drive write heads in the correct order.

A natural consequence of the striping process is that each physical drive in a given logical drive will contain the same amount of data. If one physical drive has a larger capacity than other physical drives in the same logical drive, the extra capacity is wasted because it cannot be used by the logical drive.

The group of physical drives containing the logical drive is termed a **drive array,** often abbreviated to just **array.** Since all the physical drives in an array are commonly configured into just one logical drive, the term array is also often used as a synonym for logical drive. However, an array can contain several logical drives (refer to Figure A-4), each of a different size.

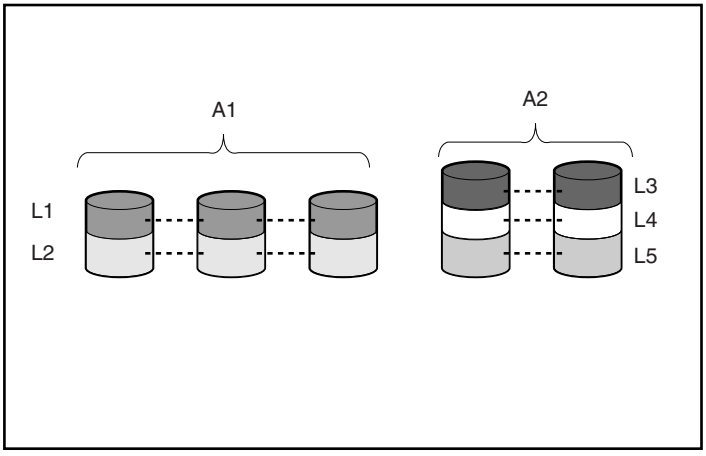

Figure A-4: Two arrays (A1, A2) containing five logical drives spread over five physical drives

Each logical drive in an array is distributed over all of the physical drives within the array. A logical drive can also extend over more than one port on the same controller, but it cannot extend over more than one controller.

Drive failure, although rare, is potentially catastrophic. In Figure A-4, for example, failure of **any** physical drive causes **all** logical drives in the same array to fail, and all data on the drives is lost.

To protect against data loss due to physical drive failure, logical drives are configured with **fault tolerance.** There are several fault-tolerance methods; those supported by current Compaq controllers (and described in the following section) are:

- RAID 0—Data Striping only (no fault tolerance)
- RAID 1 (sometimes called RAID 1+0)—Drive Mirroring
- RAID 5—Distributed Data Guarding
- RAID ADG—Advanced Data Guarding

For any configuration except RAID 0, further protection against data loss can be achieved by assigning an **online spare** (or **hot spare**). This is a physical drive that contains no data and is connected to the same controller as the array. When a physical drive in the array fails, the controller automatically rebuilds information that was originally on the failed drive onto the online spare. This quickly restores the system to full RAID-level data protection. (However, in the unlikely event that another drive in the array should fail while data is being rewritten to the spare, the logical drive will still fail.)

When you configure an online spare, it is automatically assigned to all logical drives in the same array. Additionally, you do not need to assign a separate online spare to each array; you can configure one hard drive to be the online spare for several arrays, as long as the arrays are all on the same controller.

Fault-Tolerance Methods

RAID 0—No Fault Tolerance

This configuration (refer to Figure A-3) provides no protection against data loss when a drive fails. However, it is useful for rapid storage of large amounts of non-critical data (for printing or image editing, for example), or when cost is the most important consideration.

Advantages

- Highest performance method for writes
- Lowest cost per unit of data stored
- All drive capacity is used to store data (none needed for fault tolerance)

Disadvantages

- All data on the logical drive is lost if a physical drive fails
- Cannot use an online spare
- Can only preserve data by backing it up to external drives

RAID 1—Drive Mirroring

In this configuration, data is duplicated onto a second drive.

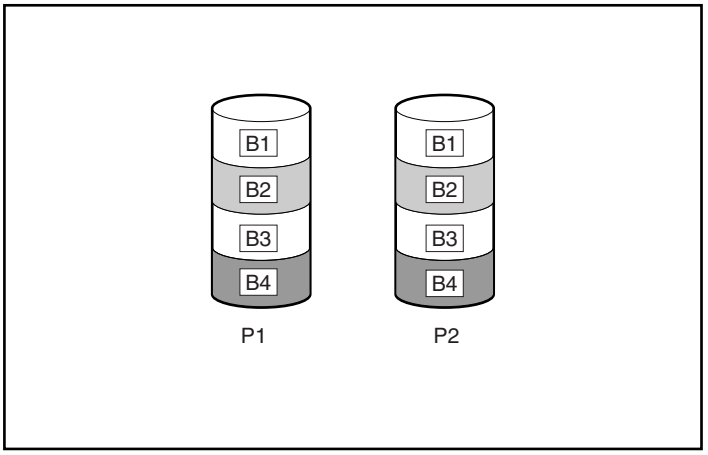

Figure A-5: Drive mirroring of P1 onto P2

When the array has more than two physical drives, drives are mirrored in pairs.

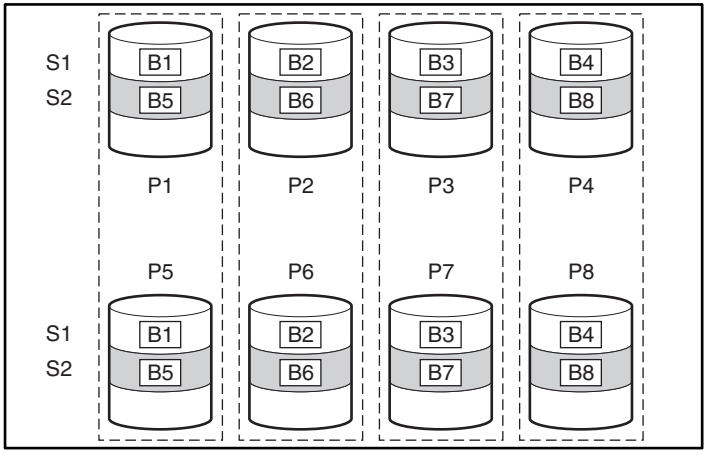

Figure A-6: Mirroring with more than two physical drives in the array

In each mirrored pair, the physical drive that is not busy answering other requests answers any read request sent to the array (this is termed **load balancing**). If a physical drive fails, the remaining drive in the mirrored pair can still provide all the necessary data. Several drives in the array can fail without incurring data loss, as long as no two failed drives belong to the same mirrored pair.

This fault-tolerance method is useful when high performance and data protection are more important than the cost of physical drives.

NOTE: When there are more than two physical drives in the array, this fault-tolerance method is sometimes referred to as RAID 0+1 or 1+0. However, these terms are ambiguous, because different equipment manufacturers define and implement these methods in slightly different ways.

Advantages

- Highest read and write performance of any fault-tolerant configuration
- No loss of data as long as none of failed drives are mirrored to another failed drive (up to half of the physical drives in the array can fail)

Disadvantages

- Expensive (many drives needed for fault tolerance)
- Only 50% of total drive capacity useable for data storage

RAID 5—Distributed Data Guarding

By this method, a block of **parity data** is calculated for each stripe from the data that is in all other blocks within that stripe. The blocks of parity data are distributed over every physical drive within the logical drive (refer to Figure A-7). When a physical drive fails, data that was on the failed drive can be calculated from the user data on the remaining drives and the parity data. This recovered data is usually written to an online spare in a process called a **rebuild.**

This configuration is useful when cost, performance, and data availability are equally important.

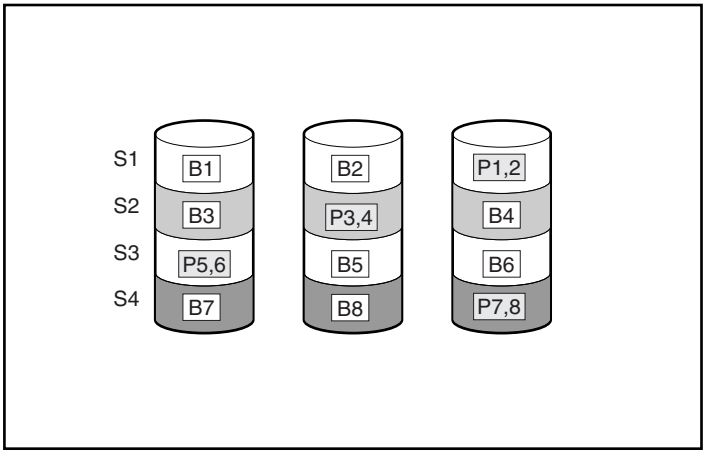

Figure A-7: Distributed data guarding, showing parity information (Px,y)

Advantages

- High read performance
- No loss of data if one physical drive fails
- More drive capacity usable than with RAID 1—parity information requires only the storage space equivalent to one physical drive

Disadvantages

- Relatively low write performance
- Loss of data if a second drive fails before data from the first failed drive is rebuilt

RAID ADG—Advanced Data Guarding

RAID ADG is similar to RAID 5 in that parity information is generated (and stored) to protect against data loss caused by drive failure. With RAID ADG, however, two different sets of parity data are used. This allows data to still be preserved if two drives fail. As can be seen from Figure A-8, each set of parity data uses up a capacity equivalent to that of one of the constituent drives.

This method is most useful when data loss is unacceptable, but cost must also be minimized. The probability that data loss will occur when arrays are configured with RAID ADG is less than when they are configured with RAID 5 (refer to Appendix B for details).

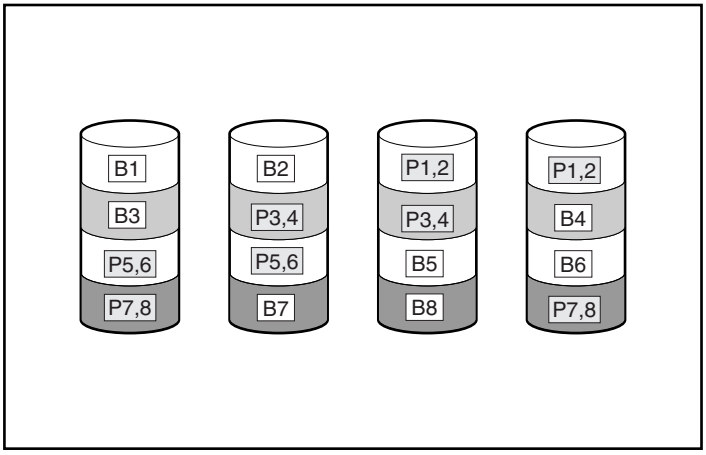

Figure A-8: Advanced data guarding (RAID ADG)

Advantages

- High read performance
- High data availability—any two drives can fail without loss of critical data
- More drive capacity usable than with RAID 1—parity information requires only the storage space equivalent to two physical drives

Disadvantage

The only significant disadvantage of RAID ADG is a relatively low write performance (lower than RAID 5), due to the need for two sets of parity data.

Table A-1 summarizes the important features of the different kinds of RAID described here. The decision chart in Figure A-9 may help you to determine which option is best for your situation.

Table A-1: Summary of RAID Methods

	RAID 0	RAID 1	RAID 5	RAID ADG
Alternative name	Striping (no fault tolerance)	Mirroring	Distributed Data Guarding	Advanced Data Guarding
Usable drive space*	100%	50%	67% to 93%	50% to 96%
Usable drive space formula	*n*	*n*/2	(*n*-1)/*n*	(*n*-2)/*n*
Minimum number of physical drives	1	2	3	4
Tolerates failure of 1 physical drive?	No	Yes	Yes	Yes
Tolerates simultaneous failure of >1 physical drive?	No	Only if no two failed drives are in a mirrored pair	No	Yes
Read performance	High	High	High	High
Write performance	High	Medium	Low	Low
Relative cost	Low	High	Medium	Medium

*Values for usable drive space are calculated with these assumptions:

- All physical drives in the array have the same capacity.
- Online spares are not used.
- No more than 14 physical drives are used for RAID 5 (this number is recommended so that the risk of logical drive failure is kept low; refer to Appendix B for further information).
- No more than 56 physical drives are used for RAID ADG (in this case, the limitation is the number of physical drives that can be connected to the controller).

MOST IMPORTANT	ALSO IMPORTANT	SUGGESTED RAID LEVEL
Fault tolerance	Cost effectiveness	RAID ADG
	I/O performance	RAID 1
Cost effectiveness	Fault tolerance	RAID ADG
	I/O performance	RAID 5 (RAID 0 if fault tolerance is not required)
I/O performance	Cost effectiveness	RAID 5 (RAID 0 if fault tolerance is not required)
	Fault tolerance	RAID 1

Figure A-9: Choosing a RAID method

Other Fault-Tolerance Options

Your operating system may also support software-based RAID or controller duplexing.

- **Software-based RAID** resembles hardware-based RAID, except that the operating system works with logical drives as if they were physical drives. To protect against data loss caused by physical drive failure, each logical drive must be in a different array from the others.
- **Controller Duplexing** uses two identical controllers with independent, identical sets of drives containing identical data. In the unlikely event of a controller failure, the remaining controller and drives will service all requests.

However, the hardware-based RAID methods described in this Appendix provide a much more robust and controlled fault-tolerant environment. Additionally, controller duplexing and software-based RAID do not support online spares, auto-reliability monitoring, interim data recovery, or automatic data recovery.

If you decide to use one of these alternative fault-tolerance options, configure your arrays with RAID 0 for maximum storage capacity and refer to your operating system documentation for further implementation details.

B

Probability of Logical Drive Failure

The probability that a logical drive will fail depends on the RAID level setting.

- A RAID 0 logical drive fails if only one physical drive fails.
- For a RAID 1 logical drive, the failure situation is complex.
  - The **maximum** number of physical drives that can fail without causing failure of the logical drive is *n*/2, where *n* is the number of hard drives in the array. This maximum is reached only if no failed drive is mirrored to any other failed drive. In practice, a logical drive usually fails before this maximum is reached. As the number of failed drives increases, it becomes increasingly unlikely that a newly failed drive is not mirrored to a previously failed drive.
  - The failure of **only two** physical drives is enough to cause a logical drive to fail **if** the two drives happen to be mirrored to each other. The risk of this occurring decreases as the number of mirrored pairs in the array increases.
- A RAID 5 logical drive (with no online spare) fails if two physical drives fail.
- A RAID ADG logical drive (with no online spare) fails when three physical drives fail.

At any given RAID level, the probability of logical drive failure increases as the number of physical drives in the logical drive increases.

The graph in Figure B-1 provides more quantitative information. The data for this graph is calculated from the mean time between failure (MTBF) value for a typical physical drive, assuming that no online spares are present. Adding an online spare to any of the fault-tolerant RAID configurations further decreases the probability of logical drive failure by a factor of about a thousand.

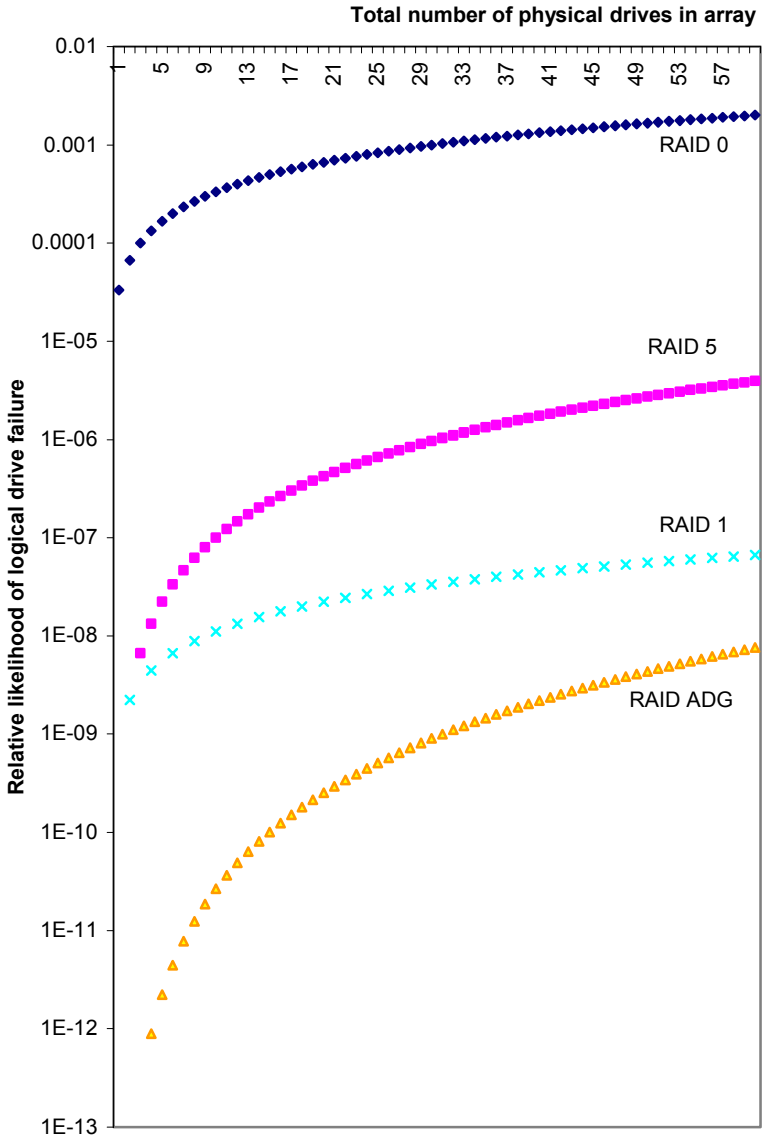

Figure B-1: Probability of logical drive failure

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